Trade policy reforms in the new agricultural context : Is regional integration a priority for Sub-Saharan African countries agricultural-led industrialization ?

Insights from a global computable general equilibrium analysis.

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Abstract

Global general equilibrium simulations of "regional" (within Sub-Saharan Africa –SSA-) and "multilateral" (Doha and preferential) trade integration are compared to assess policy reform priorities. Their coherence with the objective of agriculture-led industrialization is tested. New results reveal that for SSA regional integration delivers as much as multilateral integration. Multilateral liberalization drives Sub-Saharan African countries further away from agricultural-led industrialization. On the contrary regional integration fosters the production and trade of processed agricultural products. Regional integration has heterogeneous impacts on countries in SSA and gains might be concentrated on a few countries. Accompanying redistributive policies to compensate the loosers might help bring the negotiations further.

JEL codes: F15, F47, O19, O24, O55, Q17

Keywords: Trade policy, market integration, agriculture, computable general equilibrium, trade preferences, Sub-Saharan Africa.

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1. Introduction

Considering the proliferation of trade negotiations, there is little academic guidance in either the theoretical or empirical literature to help countries from Sub-Saharan Africa[2] (SSA) set priorities for trade policy reforms and ensure that their commitments are instrumental to broader development strategies. Based on the assumption that the pattern of trade integration affects agricultural development, this research starts to fill those gaps. First, rather than focusing on one specific trade agreement, the main ones that negotiators in SSA have to choose from are broadly considered and new comparable results are brought forward on the impacts of bilateral, regional (within SSA) and multilateral (global) agreements, and their interactions. This is a necessity since existing empirical assessments of trade integration differ by the data, behavioral parameters, or theoretical features and cannot be considered comparable (Bouët 2008). Second, it will depart from traditional trade literature by following up from insights of agricultural economics on agricultural-led industrialization (Reardon and Timmer 2005).

In a context of global economic and financial crisis governments in SSA are urged to avoid the luring food crisis and adopt a long term strategy to pull their countries out of food insecurity and poverty. Since on average in the region agriculture is still a major source of employment, an essential part of foreign exchange earnings and of government fiscal revenues (FAO 2010), governments[3], the donor community[4] and international institutions (World Bank 2008) are increasingly arguing that agricultural growth is the way to do so. Research on the spillover effects of agriculture growth on overall economic growth (among others Delgado *et al.* 1994, Haggblade, Hazell and Reardon 2007, Self and Grabowski 2007) have contributed to that recent shift. But academic debates on the strength of the intersectoral linkages in the context of globalized agricultural markets and on the pro-poor impacts remain (Christiaensen, Demery and Kuhl 2011). From an analytical point of view, computable general equilibrium (CGE) models, traditional tools of economic policy analysis, are convenient to capture those linkages.

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[2]   "SSA" refers here to all the countries in the African continent below the Sahara, as opposed to northern Africa. SSA is composed of Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Saint Helena, Sierra Leone, Togo Nigeria, Senegal, Ethiopia, Madagascar, Malawi, Mauritius, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe, Botswana, South Africa, Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon, São Tomé and Principe, Angola, Democratic Republic of Congo, Burundi, Comoros, Djibouti, Eritrea, Kenya, Rwanda, Seychelles, Somalia, Sudan, Lesotho, Namibia, Swaziland. Note that Mayotte and the Reunion are not assumed to be part of SSA but are included in some of the database used.

[3]   See the African Union Maputo Declaration on Agriculture and Food Security of 2003.

[4]   See the G8 l'Aquila Food Security Initiative in 2009 and the G20 "Action plan on food price volatility and agriculture" in 2011.

Poor performance of the agricultural sector is a long-term structural problem in Africa (Adesina 2010). SSA's share in agricultural global trade value decreased from five percent in 1960 to less than two percent in 2008. The trade literature concerned with this increasing marginalization of SSA in global trade highlights two common explanations that are either the poor economic performance of the region as a whole compared to other developing regions (Rodrik 1998); or the lack of competitive gains in primary and agricultural commodities (most of exports) leading to the erosion of historical market shares displaced by similar goods from competing countries (Ng and Aksoy 2008). Additionally, anti-agricultural and antitrade biases of past global and domestic policies in Africa have been highlighted by the recent research program on agricultural distortions of the World Bank (Anderson and Masters 2009) confirming earlier analyses (Krueger, Schiff and Valdes, 1988). Even if structural adjustment policies have reduced domestic bias against agriculture in most African countries since the 90s (Jensen, Robinson and Tarp 2010), some domestic distortions remained while increased supports and import barriers were provided to protect farmers in more well off countries. Development economics further emphasize the fact that macroeconomic policies in Africa have been insufficiently linked with micro-level realities (Bhorat, Hanival and Kanbur 2006), while the micro-level policies implemented with no consideration for the macroeconomic context have failed. Finally, political economy analysis have showed that since the 1980s economic reforms in Africa have been more driven by external political prescriptions of the World Bank than by the political economy influence of protectionist pressure groups (Jones, Morrissey and Nelson 2010). Several analyses have showed that severe analytical and negotiation capacity constraints hinder independent analysis and assessment of the potential implications of trade agreements for their economies (UNCTAD 2010). It is thus critical to compare trade policy opportunities based on their coherence with SSA priorities of agricultural growth and broader development objectives (de Janvry and Sadoulet 2010).

In the rest of the paper, we will first present the CGE methodology. Second, we will justify the focus on the comparison of the regional and multilateral trade integration scenarios. The last part will present the main results, and discuss their comparative impacts, and their sensibility to alternative outcome of the negotiations with the EU.

2. Assessing the impacts of trade on the agricultural development strategy

According to the literature review of Harrison, McLaren and McMillan (2010), economic theory cannot predict the detailed impacts of trade liberalization. Thus the answer to our research question is empirical.

2.1. The rationale for global general equilibrium modeling

According to the empirical trade literature, the outcomes of trade policies depend on the relative impacts on competitors (Low, Piermartini and Richtering 2005 and Carrere and de Melo 2010). It is thus necessary to conduct empirical trade policy analysis at a global level in order to compare different trade integration levels. Global general equilibrium enables us to study the evolution of the agricultural sector together with changes in the socioeconomic and macroeconomic structures of open economies (Sadoulet and de Janvry 1995). We use the Modeling International Relationships in Applied General Equilibrium (MIRAGE) global model, initially developed by the Centre d'Études Prospectives et d'Informations Internationales (CEPII) (Decreux and Valin 2007) described in Appendix A.

Following Davis and Mishra's (2007) advice, far from taking advantage of all the specifications MIRAGE has to offer, we complexify the model only to the extent that it is needed to adequately answer our question. We consider perfect competition, since imperfect competition significantly affects results (Karam 2009) introducing a bias detrimental to countries' specialization in agriculture (Decreux and Valin 2007) which we want to avoid when focusing on countries where most households depend on agriculture and value the diversity of agricultural goods (Katungi *et al.* 2011), and a static mode, since the focus is on the comparison of the long-term effect of multiple scenarios.

All trade liberalization scheme produces contrasted impacts across sectors and countries (Winters McCulloch and McKay 2004) but the facts that, as most other global CGE models, MIRAGE has one representative agent and relies on the GTAP 7 database (Global Trade Analysis Project of Purdue University, which is the most used database for trade policy analysis) limit the analysis of distributional impacts. Indeed only 13 of the 52[5] countries of

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[5] Individual countries are Nigeria, Senegal, Ethiopia, Madagascar, Malawi, Mauritius, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe, Botswana, and South Africa.

Regions are Rest of Western Africa (Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Saint Helena, Sierra Leone, Togo), Rest of Central Africa (Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon, São Tomé and Principe), Rest of South Central Africa (Angola, Democratic Republic of Congo), Rest of

SSA appear individually in the GTAP 7 database, and the rest are included in five regions, grouping highly heterogeneous countries. Furthermore, the agricultural sectors of specific importance for SSA, other than grains, are not detailed in the GTAP 7: Roots and tubers are not separated and traditional export crops such as coffee, cocoa, cotton, tea, and tobacco are aggregated into the "exportable other crops" sector.

There are several ways that previous studies address these issues, using alternative databases, and linking the global model to national or sub-national general equilibrium models and household data (Bourguignon, Bussolo and Cockburn, 2010). The easiest way to link the global model to the household level is through a poverty elasticity, a parameter supposed to express how poverty incidence is reduced when an index representative of what poor people gain increases as Bouët (2008) demonstrates, the main shortcoming of the poverty elasticity parameter is that it only accounts for the inequality effects of reforms to the extent that it is estimated for a wide range a different household types. By using a "country stratum-factor price-poverty line specific poverty elasticities" as in Hertel *et al.* (2007), there are strong shortcomings Furthermore applying the concept of poverty elasticity gives the impression that the relation between trade openness and poverty alleviation is mechanical. Thus, this paper will not try to assess the impacts of trade integration on poverty, but will rather look at the contrasting impacts across countries and regions as in Bouët *et al.* (2005) based the changes in gross domestic product (GDP),equivalent variation of the consumer utility function as a measure of welfare (as defined in Sadoulet and de Janvry 1995), and other macroeconomic indicators. It will go further than previous studies by trying to also assess the coherence of trade reforms with the agricultural development strategies of countries in SSA.

2.2. Assessing the impacts of trade on the agricultural development strategy

The trade literature has not looked into the issue of agricultural-led industrialization so far. It rather classifies agriculture in Africa between "traditional agricultural exports", "food stuff" and "nontraditional exports" or "commercial" and compare the respective growth perspective from those different types of exports. For instance Diao and Dorosh (2007) look at the impact of different productivity growth in SSA and suggest that rapid agricultural growth in SSA could be constrained by current global demand, particularly for nontraditional exports. They also underline that productivity growth in foodstuff offers more potential for

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eastern Africa (Burundi, Comoros, Djibouti, Eritrea, Kenya, Mayotte, Reunion, Rwanda, Seychelles, Somalia, Sudan), and Rest of South African Customs Union (Lesotho, Namibia, Swaziland).

major impacts on poverty and food consumption. The recent work by Poulton *et al.* (2009) summarizing the lessons learned from past experience of success and failure with commercial agriculture in Africa analyses the sources of competitiveness of African agricultural exports and finds that few African countries are competitive at the international level, but many of them are at the regional level. Both of those studies emphasize that the regional markets in SSA might represent more interesting opportunities for countries in SSA than international markets. Neither of those studies, however, look at the changing trade environment nor the impacts of increased market access for SSA.

According to the agricultural economic literature, global market composition has changed considerably over the years and has been characterized by an increasing level of processed goods. Reardon and Timmer (2005) have shown that those changes in demand patterns have driven the agrifood industry structural transformation within developing countries. From the GTAP 7 data, we find that SSA is the region of the world that is processing the least part of its agriculture production, with less than 50 percent in 2004; whereas more than 70 percent of its agriculture imports are processed, as compared to 80 percent of developed countries's agricultural imports. According to those data, there would already be scope for SSA to process more its agricultural production, and increase exports of processed products to answer an existing demand both from regional and international markets.

Reardon *et al* (2009) show that the overall growth and poverty effects of the development of those modern agricultural value chains are determined by the labor effects and more generally the spillovers effects in the economies. But analysis of the micro-level determinants of developing countries producers' integration in the global agricultural supply chains (Gomez *et al.* 2011) also highlight the complex supply side constraints they are facing. These supply-side constraints are due to inadequate transportation, storage and communication infrastructures in the countries, but also to the low levels of productivities of the farmers and their little technical or financial capacity to raise it on their own. It prevents many of them, and especially poor farmers within them, from taking advantage of any opportunities that arise (see for instance de Janvry, Fafchamps and Sadoulet 1991). Unfortunately, as in most CGE models, supply side constraints are not well represented in MIRAGE, despite assumptions of imperfect reallocation of factors of production. We thus rather consider that such CGE study enables comparing market opportunities from the demand-side.

In order to analyze the stake of agricultural led industrialization, we distinguish agricultural commodities according to whether they are sold raw or processed and according to the destination market whether regional in SSA or the rest of the world.

The regional and sectoral mapping, focusing on SSA agricultural sectors, is described in Appendix A. Results for each scenario are available for the 29 regions, of which 18 are SSA, and the 28 sectors, of which 18 are agricultural. In the remainder of the analysis, for simplicity, the results are presented aggregated in five "zones of interest" as detailed in Table II.B.2 and "sectors of interest" in Table II.B.1, but detailed results are available upon request.

3. The trade scenarios

There is a renewed interest by all governments in SSA and some development agencies in accelerating regional integration[6]. While some observers see this desire for increased regional integration as purely politically motivated, some of the economic arguments include the newly recognized growth potential of domestic and regional consumer markets (UNECA 2010), and the scope in SSA to intensify agricultural processing activities domestically before exporting goods to regional and international markets, presented above. Apart from those arguments, and despite a large literature on regional trade integration in Africa, evidence on the expected impacts from implementing the regional agreements currently negotiated is scarce (te Velde and Meyn2008). Economic theory predicts from Viner (1950) that the effects of regional trade integration can be either net trade creating or net trade diverting depending whether trade created among partner countries is additional or replace trade with the rest of the world. Few global general equilibrium studies have simulated the impacts of regional integration within SSA, because of the lack of reliable data, the problem of informal, unreported trade, but maybe also because of the consensual theoretical predictions from the Vinerian framework (and further developments) that multilateralism is superior to regionalism since it does not entail risk of trade diversion and that in any case developing countries are better off integrating with developed countries than with other developing countries as is apparent in the conclusions of Schiff and Winters (2003) summarizing World Bank research on regional integration and development.

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[6] See the Outcome Statement of the "Joining up Africa: Regional Integration" conference agreed in London, United Kingdom on March 4th 2010 by representatives from the African Development Bank, the World Bank, the European Commission, the WTO and the Department for International Development (DFID). See also the declarations at the 18th African Union Summit on "Boosting Intra-Trade" on 23-30 in Addis Ababa, Ethiopia.

On the contrary a large strand of the empirical trade literature focus on the prospects from further trade liberalization at the global level. Since results of the general equilibrium studies looking at the global trade liberalization have been used in the political negotiations at the World Trade Organization (WTO) they have been surrounded by many debates (Devarajan and Robinson, 2005). A lot of attention has been devoted to try to test the political argument that the Doha Development Agenda (DDA) would be beneficial for development by looking at its impacts on developing countries and SSA in particular. As a consequence many studies have focused on this question, testing the impacts of slight variations on the terms of the agreement, and of each component of the negotiations (Anderson Martin and Van der Mensbrugghe, 2006).

Two main mechanisms have been identified as having potential negative effects on some developing countries. The first one is the anticipation that net food importing countries would be negatively impacted by increased international price of food commodities (Panagariya 2005). Considering that distorting domestic policies (agricultural supports and export subsidies) from developed countries for some staples (mainly meat, milk, wheat, maize, rice) have contribute towards an excess production, artificially lowering international prices for those commodities, de Janvry and Sadoulet (1992) showed that the elimination of these distortions will increase international prices of those commodities. Bouët *et al.* (2005) further show that net food importing low income countries can still benefit from increased trade liberalization if increases in food prices are more than compensated by increases in the prices of their exports.

The second mechanism is the prediction that the countries currently granted high preferential margins, such as Sub-Saharan African countries, would experience an erosion of those preferences from multilateral liberalization and terms of trade loss with increased competition on their exports (Bouët, Mevel, and Orden 2007). It is the development of a new database taking into account the existing preferential agreements, the Market Access Maps database developed by the CEPII and the International Trade Center (ITC) (MAcMapHS6) (Bouët *et al.* 2008) that has enabled to capture those effects in global simulations framework. MAcMapHS6 2004 represents the full structure of protection, bound, MFN applied, and preferential[7] applied duties in 2004 at the bilateral level.

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[7] Rules of origin are not taken into account and thus supposed to be fully used, even though there is some evidence that developing countries are not able to fully take advantage of those preferences.

With the recognition that some poor countries, especially Least Developed Countries (LDC) might suffer from adverse effects from the DDA, a Duty-Free Quota-Free (DFQF) market access towards LDCs was recently included in the Doha Round negotiations. This addition to the Doha "package" is now used as a definitive argument that a successful conclusion of a Doha Round is bound to be highly beneficial for African countries (Lamy 2011).

Considering the high political stakes involved in the regional and multilateral negotiations, it seems essential delivering quantitative results to fuel the debates on whether multilateral and regional trade integrations are coherent with development objectives, coherent with one another and whether one type of trade integration should be a priority over the other.

Numerous simulations of the impacts of agricultural trade liberalization on Sub-Saharan African countries have been produced in the past, but only few of them compare different levels of trade agreements. The few ones that do highlight that different levels of trade integration have distinct impacts, and that interaction effects of simultaneous integration are important to take into account. Among those, Fontagné Mitaritonna and Laborde (2011) test the interaction effect of the Economic Partnership Agreement (EPA) with regional integration, Keck and Piermartini (2005) and Berisha-Krasniqi, Bouët and Mevel (2008) compare EPA with multilateral liberalization, and Kowalski and Shepherd (2006) compare North–South to South–South multilateral integration. None of them compare potential impacts of the regional and multilateral integration schemes. Since simultaneously to the regional and multilateral negotiations, EPA negotiations between the EU and countries in SSA are ongoing, it seems important to include sensibility analysis over whether potential outcomes of the EPA could impact those results.

We first analyze the scopes from further regional and multilateral market integration for SSA based on an updated version of the MAcMapHS6 2004 database MAcMapHS6. Then the scenarios and the tariff changes they imply are presented.

3.1. Scopes for further regional and multilateral market integration

First the database is updated ("pre-experiment") to include the main trade agreements between SSA and its trade partners concluded since 2004 (such as expanded DFQF by India, China, Turkey, and Korea to some LDCs; some new free trade agreements –FTAs-; and the phasing out of the EU protocols for sugar, rice, and bananas). Gains from increased

liberalization can be substantially overestimated without this step (Bouët 2008). This baseline is the reference point to which our scenarios will be compared.

TABLE II.1 — AVERAGE BILATERAL APPLIED TARIFFS BY SECTOR AND REGION

| Importer | Sector | Exporter | | | | |
		DC	EE	ODC	NA	SSA
DC	Raw ag	0.14	0.17	0.12	0.11	0.10
	Processed ag	0.18	0.17	0.16	0.11	0.14
	Fish	0.04	0.04	0.05	0.04	0.05
	Other	0.03	0.04	0.03	0.03	0.02
EE	Raw ag	0.13	0.13	0.11	0.09	0.19
	Processed ag	0.24	0.21	0.25	0.18	0.32
	Fish	0.14	0.11	0.13	0.10	0.20
	Other	0.08	0.11	0.09	0.06	0.07
ODC	Raw ag	0.12	0.20	0.17	0.20	0.15
	Processed ag	0.19	0.32	0.21	0.25	0.22
	Fish	0.22	0.21	0.21	0.14	0.21
	Other	0.07	0.11	0.08	0.07	0.09
NA	Raw ag	0.21	0.25	0.26	0.17	0.12
	Processed ag	0.40	0.26	0.37	0.18	0.82
	Fish	0.25	0.26	0.26	0.11	0.25
	Other	0.14	0.18	0.17	0.07	0.16
SSA	Raw ag	0.11	0.16	0.13	0.16	0.18
	Processed ag	0.26	0.24	0.23	0.34	0.28
	Fish	0.16	0.11	0.10	0.05	0.15
	Other	0.10	0.16	0.12	0.12	0.14

Source: MAcMapHS6 2004 after pre-experiment, reference-group weight aggregating method.
Notes: DC = developed countries; EE = emerging economies; ODC = other developing economies; NA = northern Africa; SSA = Sub-Saharan Africa. Raw ag = raw agricultural products; Processed ag = processed agriculture products; Fish = fishing products; Other = primary and manufactured products and services.

Table II.1 illustrates the stylized facts of the preferential margin of SSA and of tariff escalation.

Developed countries apply lower tariffs on exports from SSA than from other regions of the world in particular on raw agricultural imports. This preferential margin of SSA is linked to the fact that the region benefits from a preferential access to the EU which is in the MacMaps 2004 dataset the destination of the region's agricultural exports.

The tariff escalation is the fact that higher tariffs are applied on more processed goods. It is suspected to some extent to have hampered the export-led industrialization possibilities of developing countries (Matthews 2005).

Despite the existing economic integration processes (UNECA 2010) countries in SSA apply a higher level of protection on regional trade than other regions.

Hence there is still scope to increase market integration both at the regional and multilateral level with possible beneficial impacts on agricultural-led industrialization.

Several scenarios of multilateral and regional agreements are simulated and compared with this baseline. There are summarized in the Table II.2 and presented below.

TABLE II.2 — SCENARIOS SIMULATED

Scenario	Description
Multiletral scenarios	
DDA	Successful conclusion of the Doha negotiations: Multilateral reduction of bound tariff barriers of all countries except LDC according to the December 2008 modalities.
DFQF	Complete elimination of all applied tariff barriers imposed by OECD countries, Brazil, China, and India on imports from all LDCs.
DDA+DFQF	Combined tariff reductions of the DDA and the DFQF scenarios.
Regional Scenarios	
Reg FTA	Constitution of four subcontinental FTAs in SSA: Complete elimination of applied tariff barriers between countries of the same FTA.
SSA FTA	Constitution of one subcontinental FTA in SSA: Complete elimination of applied tariff barriers between Sub-Saharan African countries.
Interactions	
DDA+ Reg FTA	Combined tariff reductions of the DDA and the Reg FTA scenarios.
DFQF+Reg FTA	Combined tariff reductions of the DFQF and the Reg FTA scenarios.
DDA+DFQF+Reg FTA	Combined tariff reductions of the DDA, the DFQF and the Reg FTA scenarios.
Alternative baselines	
EPA	Bilateral EPA concluded between each ACP country and the EU: Elimination of applied tariffs between the EU and each ACP country. Tariffs applied on the imports of some sensitive products from the EU as defined by each ACP country (IEPA) are unchanged.
GSP	Each ACP country is transferred to the corresponding preferential scheme of the EU: EU eliminates applied tariff barriers on all imports from ACP LDCs. Applied tariffs on imports from ACP non LDCs are set the level of the GSP agreement.

3.2. "DDA" scenario: multilateral liberalization in the form of a "Doha Development Round"

The November 2001 declaration of the Fourth Ministerial Conference of the World Trade Organization (WTO) in Doha, Qatar, provides the mandate for negotiations known as the "Doha Round". The Doha Development Agenda was to take into account the specific needs of developing countries. The July 2008 package is considered a stepping-stone on the way to concluding the Doha Round, and the December 2008 draft modalities text seems to be widely accepted by WTO members as the basis for further negotiations.[8]

Since then, no substantial achievement to conclude the Doha Round has been made, and trade liberalization has, on the contrary, evolved at the bilateral and regional level.

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[8] Based on latest updates of http://www.wto.org/.

The "DDA" scenario[9] is based on the December 2008 modalities (WTO 2008a, 2008b) in a similar scenario to Bouët and Laborde (2010). The tariff reduction formula is applied on base rates equal to existing bound tariffs or for currently unbound tariff lines, to average applied MFN rate for 2004 (from MAcMapHS6-2.1) plus 25 percent. Details of the state of the negotiations and the tariff reduction formulas and the flexibilities are described in Laborde and Martin (2011a, 2011b).

The simulation of Doha in this research does not include all flexibilities. For nonagricultural products, the Swiss tariff-cutting formula with an 8 percent coefficient is used for all developed countries and a 23 percent coefficient is chosen for developing countries. Small and vulnerable economies, as defined by the WTO, are allowed to only cut their tariff to the mean between the value found with the Swiss formula with 23 percent coefficient and their base rate. For agricultural products, the tiered formula is used with the proportional cuts for each tariff band. For developed countries, the cut is 0.685 for tariffs above 0.75, 0.685 for tariffs between 0.75 and 0.50, 0.575 for tariffs between 0.50 and 0.25, and 0.50 for tariffs under 0.25. Developing countries have larger bands (1.3, 0.8, and 0.3) and cuts in each band are two-thirds those of the developed countries. Small and vulnerable economies can make reductions 10 percent smaller in each band than other developing members. Additional flexibilities are available for the sensitive and special products, defined using the Jean, Laborde, and Martin (2010) method[10]: cuts for sensitive products are two-thirds those for other agricultural products for both developed and developing countries, and developing countries can make reductions of 15 percent for special products. The cotton initiative adds free market access by developed countries to LDCs for cotton.

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[9]   Detailed formula available upon request.

[10]   Thanking David Laborde for having made that list available.

TABLE II.3 — DDA SCENARIO: PERCENTAGE TARIFF CHANGE ON APPLIED TARIFFS BY SECTOR AND REGION

Importer	Sector	Exporter				
		DVD	EE	ODC	NA	SSA
DC	Raw ag	-32.15	-35.58	-36.23	-43.03	-34.49
	Processed ag	-36.24	-43.03	-39.46	-37.66	-35.37
	Fish	-51.47	-55.23	-40.55	-51.16	-51.29
	Other	-33.03	-41.31	-41.49	-43.73	-26.61
EE	Raw ag	-0.21	-0.23	-0.28	-0.54	-0.11
	Processed ag	-5.04	-1.62	-2.83	-6.27	-9.95
	Fish	-25.78	-22.81	-30.39	-27.21	-35.38
	Other	-27.17	-21.27	-29.22	-22.66	-12.90
ODC	Raw ag	-0.03	-0.28	-0.09	-0.21	-0.22
	Processed ag	-3.93	-2.29	-3.51	-4.28	-7.02
	Fish	-39.58	-28.56	-30.45	-27.15	-29.64
	Other	-12.95	-21.22	-14.77	-12.36	-9.64
NA	Raw ag	-0.03	-0.64	-0.09	-0.05	-0.23
	Processed ag	-4.62	-4.81	-6.88	-1.32	-3.04
	Fish	-46.58	-45.65	-51.40	-23.74	-47.99
	Other	-31.16	-35.07	-31.58	-30.59	-35.66
SSA	Raw ag	-7.85	-8.38	-5.04	-23.08	-15.35
	Processed ag	-8.42	-12.92	-12.62	-25.21	-22.87
	Fish	-24.70	-5.37	-9.10	-21.25	-4.77
	Other	-4.21	-7.09	-6.20	-4.88	-5.19

Source: Author's calculations, reference-group weight aggregating method.

Table II.3 shows that tariff escalation is reduced except for agricultural exports from northern African countries to developed countries. Nevertheless the fact that in the structure of most developing economies' protection pattern, a few highly protected tariff lines accounting for most of the average protection can be excluded from liberalization through the sensitive products clause substantially reduces the effective liberalization of tariff cuts as was underlined by Bouët (2008).

LDC's are exempted from tariff reduction, but non LDCs in SSA have to decrease their tariffs, although less than developed countries according to the special and differential treatment at the WTO. For instance, Nigeria has to reduce its tariffs to the benefit of other countries in SSA such as South Africa (Table II.C.1). Since non LDCs are also the countries trading the most in SSA, at the aggregate level SSA reduces its tariffs towards the rest of the World, especially on imports from Northern Africa (-23 percent on raw and processed agricultural products), and SSA (-15 percent on raw agricultural exports, -23 percent on processed agricultural exports).

3.3. "DFQF" scenario: preferential multilateral liberalization for Least Developed Countries

It was agreed at the 2005 WTO Ministerial that all developed countries would offer at least 97 percent DFQF access for LDCs. Since 2001, some Organization for Economic

Cooperation and Development (OECD) countries have already started implementing DFQF access to some LDCs. A number of emerging countries (Turkey, Korea, and China) have also put in place preferential market access albeit covering fewer products (Elliott 2010). It is crucial to take those preferential agreements that have already happened into account in the pre-experiment because they reduce the potential gains from the DFQF proposal.

Without specifically testing the interaction effects of those different agreements, Berisha-Krasniqi, Bouët and Mevel (2008) and more recently Bouët *et al.* (2010) and Bouët and Laborde (2011), using a general equilibrium model and partial equilibrium models, find that there is little to expect for LDCs from DFQF market access if this market access does not cover 100 percent tariff lines and is not extended to as many preference-giving countries as possible, including emerging markets economies. Building from their results, a very ambitious "DFQF" scenario is implemented where OECD countries and Brazil, China, and India grant a 100 percent DFQF market access to all LDCs.

TABLE II.4 — DFQF SCENARIO: AVERAGE CHANGE IN POINTS OF APPLIED TARIFFS BY SECTOR AND REGION

Importer	Sector	Exporter	
		ODC	SSA
DC	Raw ag	-0.52	-18.69
	Processed ag	-0.59	-9.37
	Fish	-2.75	-16.82
	Other	-5.34	-2.92
EE	Raw ag	-17.35	-41.67
	Processed ag	-1.76	-23.79
	Fish	-8.94	-44.45
	Other	-1.64	-14.28
ODC	Raw ag	-0.68	-14.15
	Processed ag	-0.31	-4.22
	Fish	-3.39	-9.21
	Other	-0.62	-5.29

Source: Author's calculations, reference-group weight aggregating method.
Notes: DC = developed countries; EE = emerging economies; ODC = other developing economies; NA = northern Africa; SSA = Sub-Saharan Africa. Raw ag = raw agricultural products; Processed ag = processed agriculture products; Fish = fishing products; Other = primary and manufactured products and services.

"DFQF" is mostly favorable to SSA (Table II.4) for which the equivalent average tariff cuts are much higher than from DDA. Despite higher initial tariffs for processed than for raw agricultural products, tariff cuts are more important for the former (Table II.1). This apparent paradox reflects that LDCs export more raw agricultural products than processed ones to OECD countries and emerging economies. India, "other Asian countries", and the United

States are the destinations which would have to reduce the most their tariffs on agricultural exports from SSA.

3.4. "DDA+DFQF" scenario

The DFQF market access proposal is now part of the DDA negotiation as compensation toward LDCs for the erosion of preferences they experience in the DDA. Hence a combination of the two is also simulated.

Adding "DFQF" to the "DDA" scenario brings additional tariff cuts of interest to SSA (Table II.5).

TABLE II.5 — DDA + DFQF SCENARIO: AVERAGE CHANGE IN POINTS OF APPLIED TARIFFS BY SECTOR AND REGION

Importer	Sector	Exporter				
		DVD	EE	ODC	NA	SSA
DC	Raw ag	-32.16	-35.58	-36.56	-43.03	-42.41
	Processed ag	-36.26	-43.03	-39.76	-37.66	-40.86
	Fish	-51.87	-55.23	-42.82	-51.16	-61.67
	Other	-33.04	-41.31	-43.6	-43.73	-28.92
EE	Raw ag	-0.24	-0.23	-17.59	-0.54	-41.69
	Processed ag	-5.12	-1.62	-4.47	-6.27	-29.56
	Fish	-29.13	-22.81	-36.48	-27.21	-66.49
	Other	-27.31	-21.27	-30.55	-22.66	-25.41
ODC	Raw ag	-0.33	-0.28	-0.78	-0.21	-14.36
	Processed ag	-4.01	-2.29	-3.69	-4.28	-9.91
	Fish	-49.74	-28.56	-32.19	-27.15	-34.27
	Other	-13	-21.22	-15.17	-12.36	-14.48
NA	Raw ag	-0.03	-0.64	-0.09	-0.05	-0.23
	Processed ag	-4.62	-4.81	-6.88	-1.32	-3.04
	Fish	-46.58	-45.65	-51.4	-23.74	-47.99
	Other	-31.16	-35.07	-31.58	-30.59	-35.66
SSA	Raw ag	-7.85	-8.38	-5.04	-23.08	-15.35
	Processed ag	-8.42	-12.92	-12.62	-25.21	-22.87
	Fish	-24.7	-5.37	-9.1	-21.25	-4.77
	Other	-4.21	-7.09	-6.2	-4.88	-5.19

Source: Author's calculations, reference-group weight aggregating method.
Notes: DC = developed countries; EE = emerging economies; ODC = other developing economies; NA = northern Africa; SSA = Sub-Saharan Africa. Raw ag = raw agricultural products; Processed ag = processed agriculture products; Fish = fishing products; Other = primary and manufactured products and services.

It is noteworthy in Table II.5 and Table II.C.3 that the equivalent tariff cuts are not the exact sum of tariff cuts from the two scenarios alone, since some sources of tariff reduction are the same in both agreements. For instance, an important tariff cut for Malawi is the complete elimination of tariff on the tobacco exported to the United States. But some reductions are the same in both agreements.

3.5. "Regional FTA" scenario: four regional Free Trade Agreements in Sub-Saharan Africa

Despite the substantial number of trade agreements signed among Sub-Saharan African countries, progress in regional integration is uneven across the continent (UNECA 2010). In terms of future prospects, it seems most likely that regional integration will continue, but the pace will highly depend on the willingness of the respective governments to enforce the agreements they have signed.

Considering the number of overlapping memberships of countries in SSA, the choice of a combination of regional economic communities that covers all Sub-Saharan African countries with no overlap is problematic (Figure II.1). We choose the four groups used for the EPA regional negotiations in Africa, namely, a western African group based on Economic Community of West African States (ECOWAS) members plus Mauritania; a central African group based on Monetary and Economic Community of Central Africa (CEMAC) members plus Democratic Republic of Congo and São Tomé and Principe; a southern African group named the Southern African Development Community (SADC) group based on the Southern Africa Customs Union (SACU) members plus Malawi, Mozambique, Zambia, Zimbabwe and Angola; and an eastern African group considered as one region based on two negotiating groups, one being based on the East African Community (EAC) members and the other one named the ESA (eastern and southern Africa) based on some Common Market for Eastern and Southern Africa (COMESA) members.

FIGURE II.1 — REGIONAL FTA SIMULATED AND GTAP 7 REGIONS IN SUB-SAHARAN AFRICA
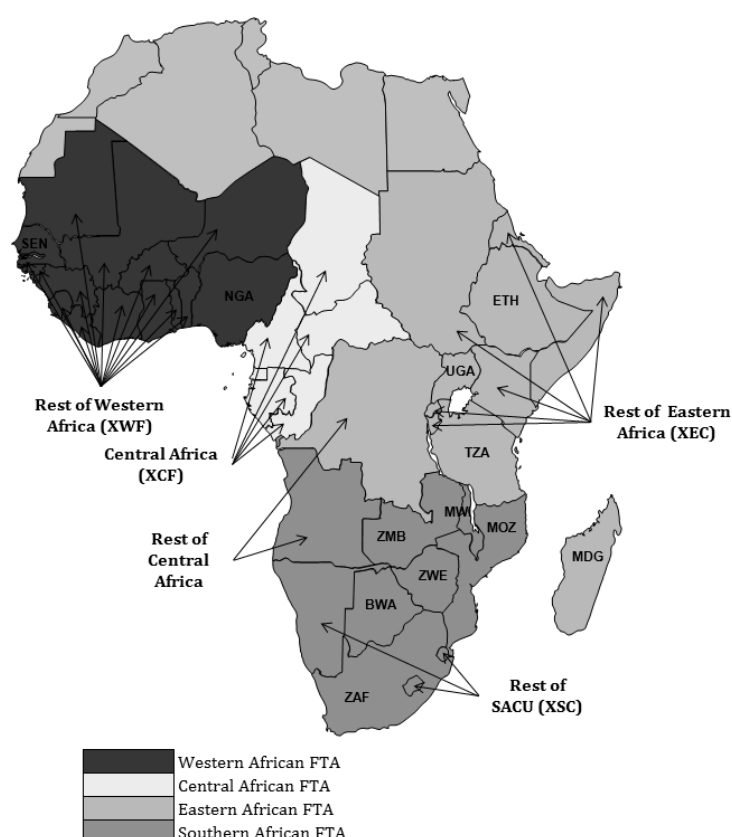
Source: GTAP 7 database region listing.

Because data on the effective applied tariff and the commitments of various agreements are hard to gather and consolidate, rather drastic regional integration scenarios were chosen. For each country in SSA, all *ad valorem* equivalent tariffs applied to imports from other countries of the same region are set to zero, creating four FTAs.

TABLE II.6 — REGIONAL FTA SCENARIO: AVERAGE CHANGE IN POINTS OF APPLIED TARIFFS BY SECTOR

Importer	Sector	Exporter
		SSA
SSA	Raw ag	-20
	Processed ag	-23
	Fish	-31
	Other	-24

Source: Author's calculations, reference-group weight aggregating method.
Notes: SSA = Sub-Saharan Africa. Raw ag = raw agricultural products; Processed ag = processed agriculture products; Fish = fishing products; Other = primary and manufactured products and services.

This scenario cuts tariffs by less than 30 percent on average in SSA (Table II.6) because countries do not trade only with the countries within the same FTA.

Table II.C.4 illustrates some of the major tariff cuts for SSA agricultural exports from regional FTAs. It reveals that some countries, such as Nigeria, Mozambique, and countries in eastern Africa, will have to drastically decrease some of their tariffs.

3.6. "SSA FTA" Scenario

An extended version of regional integration is also chosen in the form of a Sub-Saharan African Free Trade agreement ("SSA FTA"). For each country in SSA, *ad valorem* equivalent tariffs applied on imports from other countries in SSA are set to zero.

Table II.C.5 illustrates some of the major tariff cuts for SSA agricultural exports from the "SSA FTA" scenario. Most of the tariff cuts benefit exports from South Africa and western Africa.

3.7. Testing alternative baselines and interactions

All the possible interactions between the previously presented scenarios are tested. From each interaction we find what has been seen with the "DDA+DFQF": There is an interaction effect, and the outcome of simultaneous scenarios it is not a mere sum of what happens independently in the each scenario.

From the initial scenarios presented above, two alternative baselines are built depending on the outcome of the EPA negotiations. The initial results are compared with the corresponding scenarios with alternative baselines.

3.7.1. *"EPA" scenario: bilateral Economic Partnership Agreements between the EU-ACP*

According to the MAcMapHS6 database, in 2004 17 Sub-Saharan Arican countries depended on the EU for more than 50 percent of their agricultural exports. Since the EU is the main trade partner for Sub-Saharan African countries, the impacts of the potential outcomes of the current negotiations between the EU and Sub-Saharan countries should be tested on the baseline and on other scenarios.

In 2007 the WTO waiver for the Cotonou Agreements[11] ended, without the expected conclusion of the EPA being successfully signed. Initiated as regional negotiations between regional communities in the African, Caribbean, and Pacific (ACP) countries and the EU (which required countries that had overlapping memberships to those regional communities to decide with which to negotiate), the negotiations have for some time been pursued on a bilateral basis with the EU.

We consider either that EPA negotiations are successful and applied *ad valorem* equivalent tariffs between the EU and each ACP country are set to zero (Table II.C. 6). Tariffs of the sensitive products are excluded from any cuts. As, only the countries that signed Interim EPA (IEPA) have published their list of sensitive products, these lists are extended to the other countries of the same regional group who have not signed the IEPA[12]

Overall the "EPA" scenario is equivalent to tariff cuts ranging from 4 to 19 percent (Table II.7) on tariffs applied by countries in SSA on imports from all developed countries, and tariff cuts ranging from 11 to 35 percent on tariffs applied by all developed countries on imports from countries in SSA.

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[11] The Cotonou Agreement signed in 2000 had replaced the Lomé Convention, which had been the basis for ACP-EU development cooperation since 1975, providing non reciprocal preferential access for all ACP countries to the EU market. The Cotonou Agreements, however, were supposed to be transitional toward the EPAs in which ACP countries would also provide duty-free access to their own markets for EU exports.

[12] Specifically: In the western African group, Ghana and Côte d'Ivoire have their own exclusion lists from their individual IEPA. For the other countries, we use Ghana's list. For all central African countries we use the list of Cameroon's IEPA. In eastern Africa, EAC countries, Comoros, Madagascar, Maurice, Seychelles, Zambia, and Zimbabwe all use their own IEPA exclusion list. For the other countries, we use the EAC exclusion list. For all southern African countries, we use the SAD-1 IEAP exclusion list. All lists were found at http://ec.europa.eu/trade/wider-agenda/development/economic-partnerships/.

TABLE II.7 — BILATERAL ACP-EU EPA SCENARIO: AVERAGE CHANGE IN POINTS OF APPLIED TARIFFS BY SECTOR AND REGION

Importer	Sector	Exporter		
		DC	ODC	SSA
ODC	Raw ag	0.00		
	Processed ag	0.00		
	Fish	-0.01		
	Other	-0.02		
SSA	Raw ag	-0.15		
	Processed ag	-0.19		
	Fish	-0.04		
	Other	-0.17		
DC	Raw ag		0.00	-0.15
	Processed ag		-0.02	-0.35
	Fish		-0.01	-0.11
	Other		-0.01	-0.29

Source: Author's calculations, reference-group weight aggregating method.
Notes: DC = developed countries; ODC = other developing economies; NA = northern Africa; SSA = Sub-Saharan Africa. Raw ag = raw agricultural products; Processed ag = processed agriculture products; Fish = fishing products; Other = primary and manufactured products and services.

3.7.2. *GSP Scenario: The counterfactual scenario*

Considering the difficulties in bringing negotiations forward in the EPA, it is necessary to devise a counterfactual scenario for the case in which the EPA negotiation fails. Since 2008, all countries whose governments initiated the IEPA have benefited from the maintenance of traditional trade preferences from Cotonou. Only the ones that have refused to sign, such as Gabon, Congo, and Nigeria, are no longer Cotonou preference receivers.

Indeed, the EU has preferential programs for developing countries, an everything but arms (EBA) initiative granting all eligible LDCs DFQF access for all products but arms[13] and a Generalized System of Preferences (GSP)[14] for other developing countries. In terms of preferences, the EBA is equivalent to the Cotonou Agreement for ACP LDCs, but for the other ACP countries, the GSP would mean an increase in the tariffs they face for their exports to the EU.

A drastic counterfactual to the EPA scenario is chosen where no EPA is signed and all ACP countries are transferred to the GSP[15] scheme (LDCs are granted EBA). Considering the

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[13]   I consider that the delayed implementation for sugar, rice, and bananas has ended, and includes the end of the product protocols in the pre-experiment. Indeed, for sugar, from October 1, 2009, to September 30, 2015: ACPs have free access to the EU market, the only restriction being an automatic safeguard clause for non-LDC ACPs (Commission Regulation [EC] No 828/2009 of September 10, 2009, laid down detailed rules of application for the marketing years 2009/10 to 2014/15 for the import and refining of sugar products of tariff heading 1701 under preferential agreements). Since January 1, 2006, the EBA initiative grants DFQF access for bananas from LDCs to the EU market. Non-LDC ACP countries benefit from DFQF access under the EPA trade regime since January 1, 2008. All ACP banana exporters concluded negotiations on a full or interim EPA at the end of 2007.

[14]   Note that the GSP plus scheme is not considered.

[15]   The GSP plus scheme is not considered.

latest developments in the negotiations (Dalleau 2012), the most likely outcome of the EPA negotiations is actually an halfway situation where some countries and regions do sign the EPA and liberalize trade with the EU some others do not.

TABLE II.8 — ACP GSP SCENARIO: AVERAGE CHANGE IN POINTS OF APPLIED TARIFFS BY SECTOR AND REGION

Importer	Sector	Exporter	
		ODC	SSA
DC	Raw ag	0.00	0.00
	Processed ag	0.03	0.05
	Fish	0.00	0.01
	Other	0.00	0.00

Source: Author's calculations, reference-group weight aggregating method.
Notes: DC = developed countries; ODC = other developing economies; SSA = Sub-Saharan Africa. Raw ag = raw agricultural products; Processed ag = processed agriculture products; Fish = fishing products; Other = primary and manufactured products and services.

Overall, the increase in the tariffs applied by the EU would mean a 5 percent increase in equivalent average tariffs on processed agricultural products exports to all developed countries (Table II.8). Nevertheless, this average increase hides that impacts would be concentrated on the few ACP non-LDCs and on some specific sectors, as illustrated in Table II.C.7, such as sugar (+ 251 percent for Mauritius, + 229 percent for Zimbabwe) or vegetables and fruits (+ 19 percent central Africa, + 11 percent western Africa).

4. Analysis of the results

The different scenarios are first compared in terms of their macroeconomic impacts on real GDP and welfare at the world level and on the different "zones" of the world. This enables comparisons with results and interpretations from previous studies. Some insights on the diversity of the distributional impacts at the country level will also be given. Beyond this first step, the analysis will focus on the structure of agricultural and agro-industrial exports promoted by the integration schemes for Sub-Saharan African countries. Finally, the sensitivity of our conclusions to the scenarios modeled and to some key specifications and parameters is discussed.

4.1. Comparative impacts on aggregate real GDP and welfare

As found in previous studies such as Bouët *et al.* (2005), global gains from trade liberalization are small when expressed in terms of percentage of GDP. In our results, they

amount globally to a maximum of $[16]$53 billion of real gross domestic product (GDP) growth or $32 billion of welfare[17] growth (respectively 0.13 percent of 2004 world GDP or 0.10 percent of 2004 world welfare), reached with a combination of a DDA and a Duty-Free Quota-Free (DFQF) (see Table II.9 for aggregate real GDP change, Table II.10 for aggregate welfare change[18], and Table II.D.1 for detailed real GDP impacts on SSA).

TABLE II.9 — IMPACTS OF SCENARIOS ON REAL GDP ($ BILLIONS)

| | Absolute change (Percent change) | | | | | | |
	DDA*	DFQF*	DDA+ DFQF*	Reg FTA	SSA FTA	DDA + Reg FTA*	DFQF +Reg FTA*
DC	40.62 (0.12)	0.63 (0.00)	40.95 (0.12)	-0.02 (0.00)	-0.07 (0.00)	40.60 (0.12)	0.61 (0.00)
EE	7.60 (0.26)	-0.04 (0.00)	7.63 (0.26)	-0.02 (0.00)	-0.06 (0.00)	7.58 (0.26)	-0.07 (0.00)
ODC	2.18 (0.09)	0.37 (0.02)	2.46 (0.11)	-0.01 (0.00)	-0.02 (0.00)	2.17 (0.09)	0.35 (0.02)
SSA	0.49 (0.09)	0.23 (0.04)	0.69 (0.13)	0.33 (0.06)	0.65 (0.12)	0.80 (0.15)	0.55 (0.10)
NA	1.27 (0.47)	0.00 (0.00)	1.27 (0.47)	0.00 (0.00)	0.00 (0.00)	1.27 (0.47)	0.00 (0.00)
World	52.16 (0.13)	1.18 (0.00)	53.00 (0.13)	0.28 (0.00)	0.51 (0.00)	52.42 (0.13)	1.45 (0.00)

Source: Author's calculations from the results of the MIRAGE model.
Notes: *Scenario with specific treatment of GTAP data issues. DC = developed countries; EE = emerging economies; ODC = other developing economies; NA = northern Africa; SSA = Sub-Saharan Africa.

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[16]   All amounts thereafter are in US dollars.

[17]   As defined by the change in equivalent income.

[18]   In this section we first look at the world level welfare change as compared to the world level real GDP change. Detailed regional welfare impacts are interpreted in the next section.

TABLE II.10 — CHANGES IN WELFARE ($ BILLIONS)

Absolute change
(Percent change)

	DDA*	DFQF*	DDA+ DFQF*	Reg FTA	SSA FTA	DDA + Reg*	DFQF +Reg*
DC	33.58	0.13	33.58	-0.08	-0.17	33.51	0.05
	(0.12)	*(0.00)*	*(0.12)*	*(0.00)*	*(0.00)*	*(0.12)*	*(0.00)*
EE	-0.99	-0.21	-1.11	-0.03	-0.08	-1.02	-0.24
	(-0.05)	*(-0.01)*	*(-0.06)*	*(0.00)*	*(0.00)*	*(-0.05)*	*(-0.01)*
ODC	0.02	0.46	0.28	-0.02	-0.04	0.00	0.44
	(0.00)	*(0.03)*	*(0.02)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.02)*
SSA	0.15	0.46	0.53	0.23	0.51	0.37	0.69
	(0.03)	*(0.11)*	*(0.13)*	*(0.05)*	*(0.12)*	*(0.09)*	*(0.17)*
NA	-0.56	0.00	-0.56	0.00	0.00	-0.56	0.00
	(-0.28)	*(0.00)*	*(-0.28)*	*(0.00)*	*(0.00)*	*(-0.28)*	*(0.00)*
World	32.20	0.84	32.73	0.09	0.22	32.30	0.94
	(0.10)	*(0.00)*	*(0.10)*	*(0.00)*	*(0.00)*	*(0.10)*	*(0.00)*

Notes: *Scenario with specific treatment of GTAP data issues. DC = developed countries; EE = emerging economies; ODC = other developing economies; NA = northern Africa; SSA = Sub-Saharan Africa.

4.1.1. *Small changes at the global level*

The range of our global real GDP and welfare changes for the "DDA" scenario are similar to those of other studies with the Modeling International Relationships in Applied General Equilibrium (MIRAGE) model but differ from other more positive estimates of the World Bank and GTAP or HRT models for several reasons (Bouët *et al.* 2005; Anderson, Martin and Van der Mensbrugghe 2006). First, the studies using the MAcMapHS6-2.1 database (most studies with MIRAGE) take into account a precise measurement of protection worldwide, especially taking into account the trade preferences, regional agreements, and the gap between applied and bound protection (Bouët *et al.* 2008). Second, the choice of conservative estimates of behavioral parameters (lower elasticities of substitution for developing countries based on econometric estimations) yields lower trade flows and thus lower gains from liberalization (Bouët 2008) especially in terms of welfare. More complex theoretical assumptions (such as the imperfect mobility of factors allowed in MIRAGE) hamper reallocation of factors according to the comparative advantage and thus decrease gains (Gérard and Piketty 2008). Third, like all static simulations, our results lack the *dynamic gains of liberalization* (to start with, the increase in factor supply) that increase the results of dynamic simulations (Bouët 2008). Fourth, more importantly, by following Bouët and Laborde (2011) and excluding Asian travelers' expenditures in Africa from the exports flows being liberalized, more realistic results from multilateral liberalization are found (all scenarios with "*" at the end). Appendix E explains the issues and the treatment applied in this paper and illustrates the impacts of that treatment on the results from multilateral scenarios. It shows

that the world-level welfare increase is 83 percent smaller for DFQF than without that treatment.

4.1.2. *Multilateral liberalization erodes existing or proposed preferences*

In terms of comparative impacts, a combination of the Doha Development Agenda and the DFQF Market Access, the most ambitious scenario in terms of tariff cuts, results in higher global increase both of welfare and real GDP. But looking at the regional real GDP change driving the global change in Table II.9, we find that in the global changes in the "DDA" scenario are mostly driven by the increase in the real GDP of developed countries, whereas in the "DFQF" scenario the increase in the real GDP of LDCs (in "SSA" and "other developing economies") is of the same order of magnitude than of developed countries. When combining different trade agreements, the interactions effects that we had already identified when looking at the extent of the tariff cuts is apparent: for instance if we look for each region, none of the real GDP or welfare change from the "DDA+DFQF" scenario is the arithmetic sum of the two scenarios alone, since some changes of "DDA" and "DFQF" are similar. In the case of LDCs, the preferential access from the "DFQF" is eroded with "DDA" and some benefits of the "DFQF" alone are not found in the "DDA+DFQF" scenario. It is particularly apparent when looking at the welfare change for "SSA" in Table II.10. This illustrates two crucial points: First, simulating interactions is necessary to grasp the complicated effects of simultaneous trade agreements; second, any preferential trade agreement is jeopardized by increased multilateral trade liberalization as a consequence of erosion of preferences.

4.1.3. *The drivers of the diverging evolution of real GDP and welfare*

For most aggregate regions, GDP and welfare impacts have the same sign, except for "Rest of Africa" and "Emerging Economies" for which the diverging evolution of real GDP and welfare in the "DDA" scenario are not straightforward to interpret.

The "Rest of Africa" region is actually composed of all the Northern African countries, which share similar pattern. The "Emerging Economies" aggregate is composed of China, India and Brazil, nevertheless it appears that the changes in the aggregate real GDP and welfare are driven by China. From Table II.3, it is apparent that in the "DDA" scenario both regions have to decrease their tariffs, although less than developed countries under the special and differential treatment, while they also benefit from an increased market access. Both regions respond to that increased market access by increasing their exports, by 9 percent for

"Rest of Africa" and by 8 percent for China. Export led growth reorganizes producing activities, eventually leading to the overall increase in real GDP of respectively 0.47 percent for "Rest of Africa", and 6.5 percent for China driving the 7.6 real GDP growth of the "Emerging Economies". But global price change as a result of multilateral liberalization leading their terms of trade to deteriorate by respectively 1.20 percent and 0.39 percent. In both cases, their own tariff reduction on imports concern mainly processed foods (a decrease in tariffs applied on imports by around 5 percent) and primary products, manufacturing and industrial goods (around 30 percent of "Other"), which represent the bulk of their imports. Import demand increases as a result of tariff reduction but not enough to compensate for the loss in tariff and the tariff revenues decrease respectively by more than 20 percent for "Rest of Africa" and almost 30 percent in China. In the end, those negative changes are not totally compensated by the increased activity created by additional exports and induce a welfare decrease of respectively 0.28 percent for "Rest of Africa" and 0.10 percent for China and the "Emerging Economies".

4.1.4. *Proposed interpretations of the aggregate results*

The interpretation of those figures can lead to diverging conclusions[19]. In the past, beyond the results of the simulation exercises per se, political debates have been fueled by the classifications of "winners" and "losers" that they imply. They largely diverge between studies based on the level of aggregation, with a higher aggregation of regions and sectors hiding the contrasted distributive impacts, but also on the interpretation of the results in terms of welfare or GDP. For instance, Anderson, Martin and Van der Mensbrugghe (2006) seem to consider that the conclusion that the DDA is "development friendly" holds as long as the overall percentage increase in GDP or welfare for developing countries is higher than for developed nations or as long as their share of overall gains is higher than their initial share of global GDP. We find that, in percentage terms, GDP increases more in developing countries than developed countries (respectively, 0.20 percent and 0.12 percent) in from "DDA+DFQF". But the absolute increase in GDP is US$46 billion for developed countries and only US$12 billion for developing countries. Furthermore, based on the headcounts and the repartition of the population worldwide, 20 percent of the worldwide population in developed countries obtain 78 percent of the gains (31$/capita), when the 80 percent of the

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[19]   In the Marrakesh Agreement Establishing the World Trade Organization, it is recognized that "there is need for positive efforts designed to ensure that developing countries, and especially the least developed among them, secure a share in the growth in international trade commensurate with the needs of their economic development", which leaves the interpretation opens to debate.

world population living in developing countries only gain 22 percent of the gains (2.2$/capita).

The main conclusion from this analysis stems from looking at the real GDP and welfare changes for SSA: it appears that an ambitious regional integration ($510 million in welfare for a subcontinental FTA) could deliver as much as multilateral integration ($530 million for a combined "DDA+DFQF") for the region.

4.2. Some insight on the contrasted country-level impacts within SSA

Despite similar initial preferential schemes, countries in SSA are heterogeneously affected by the scenarios simulated as is apparent in Table II.11 on their welfare and Table II.D.1 on real GDP growth.

TABLE II.11 — IMPACTS ON WELFARE ($ MILLIONS) FOR SSA COUNTRIES

| | Initial | Absolute change | | | | | | |
		Reg FTA	SSA FTA	DDA*	DFQF*	DDA+ DFQF*	DDA+ Reg FTA*	DFQF+ Reg FTA*
Botswana	6,000	0.94	-5.35	23.64	-0.36	23.40	24.28	0.52
Central Africa	24,338	-1.56	-24.04	-48.83	5.23	-44.42	-50.24	3.71
Ethiopia	7,417	-0.12	-0.50	2.48	-0.11	2.46	2.34	-0.24
Madagascar	3,375	-0.14	-1.93	-12.08	11.69	-1.48	-12.28	11.50
Malawi	1,958	-13.18	-14.32	-7.29	32.32	21.42	-20.66	17.87
Mauritius	4,691	-0.18	-30.24	-7.01	-0.77	-6.70	-7.16	-0.71
Mozambique	5,165	-9.44	-11.55	2.05	15.10	14.33	-7.61	7.25
Nigeria	38,263	-93.75	-125.08	140.51	-14.60	128.43	64.73	-106.52
Rest of Eastern Africa	45,921	9.72	-56.05	25.10	193.42	169.01	35.68	204.12
Rest of SACU	6,038	18.79	28.19	-24.71	-3.32	-25.35	-5.70	15.84
Rest of Western Africa	50,051	157.76	125.12	-5.52	40.37	31.62	132.96	196.40
Senegal	7,783	4.81	5.97	6.95	51.36	53.14	11.35	55.03
South Africa	173,614	213.87	682.43	91.19	8.39	97.73	301.11	226.77
South Central Africa	19,620	-18.91	-17.71	-51.84	33.56	-20.41	-70.70	14.29
Tanzania	10,624	15.06	-7.07	10.32	58.03	65.34	24.92	71.30
Uganda	6,086	2.19	4.54	5.39	19.66	18.91	7.47	21.91
Zambia	4,428	-16.10	-1.64	-1.90	10.87	7.71	-18.24	-5.51
Zimbabwe	3,452	-41.90	-43.56	-3.15	1.85	-2.20	-42.21	-40.68
SSA	418,823	227.86	507.21	145.30	462.69	532.94	370.04	692.85
Numbers of "losers"		10	13	9	5	6	9	5

Source: Author's calculations from the results of the MIRAGE model.
Note: *Scenario with specific treatment of GTAP data issues.

4.2.1. *Impacts of "DDA"*

Multilateral liberalization brings additional market access for all countries in SSA. But the extent to which it is of interest depends on the specialization of each country. Indeed the "DDA" is only a partial liberalization since countries are given the possibility to exclude some tariff lines from liberalization. The opportunities that the "DDA" would bring for each country depends on the structure of its exports. As most countries in SSA are very specialized in the exports of very limited type of products which often are sensitive products, it means that many products of interests for African countries will be excluded from liberalization. Table II.C.1 shows example of the biggest tariff cuts for the agricultural sectors in SSA as a result of the DDA.

Those who are able to take advantage of these new opportunities can expand their exports. The extent to which each country is able to do it depends on its level of competitiveness compared the rest of the World. As shown in Table II.11, in SSA, it is the strongest economic powers of the subcontinent who gain most from DDA, namely Nigeria and South Africa which expand exports of primary and industrial products, and traditional export crops to the Quad (EU, USA, Japan, Canada), but also to emerging countries.

On the contrary, the LDC countries that were initially benefiting from relatively high initial preference margins tend to experience erosion of their preferences which contributes to decrease their terms of trade, other things being equal. It is the case for instance of Mauritius and Malawi who experience a growing competition on their sugar exports to the EU, and textile exports to the USA, and as a consequence decrease their exports.

But as most countries in SSA are small players at the international level, it is also important to take into account the effects of changing global prices as a result of "DDA": global raw agricultural prices decrease by 0.02 percent, primary goods by 0.08 percent and manufacturing goods by 0.05 percent. On the contrary, processed goods overall increase by 0.23 percent. Changes in those global prices will also make the terms of trade of each country vary depending on its structure of imports and exports.

In the end, excluding gains from Nigeria and South Africa, the rest of SSA experience decreases of 11 million in real GDP and 86 million in welfare[20] because of erosion of preferences, lack of competitiveness and declining terms of trade.

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[20] The Central African region composed of Cameroon, Gabon, Central African Republic, Chad, Equatorial Guinea, Sao Tome is particular since in absolute value it experiences a very slight increase in real GDP (0.11 million) and a relatively larger decrease in welfare (-

4.2.2. *Impacts of "DFQF"*

The "DFQF" scenario is particularly beneficial for the LDC countries specialized in the export of products initially highly protected and usually considered sensitive and excluded from existing preferential schemes. Those new opportunities arise from the fact that the scenario chosen covers very ambitiously (and unlikely) 100% of the products. Hence agricultural exports from LDC such as sugar, tobacco, or rice benefits from a free market access in the OECD countries, and emerging economies.

The only countries excluded from "DFQF" in SSA are the non-LDC, but only Mauritius, Nigeria, SACU, Bostwana and South Africa appear separately in the GTAP database. The other ones are aggregated in regions with LDC, so the model considers average increased market access for the regions, overestimating how the LDCs from that region might reply to that increased market access. It is the case of the "Rest of Eastern Africa" which includes Kenya, "Western Africa" including Ivory Coast and Ghana, and "Central Africa" including Cameroon, Congo and Gabon.

There are also cases where change in welfare and GDP do not match[21]. The case of Malawi is particular since despite its slightly negative real GDP change (-0.34 percent), welfare increases by 1.65 percent. The negative GDP growth can be explained by the little overall economic activity that is created in answer to the new export opportunities according to the model. Malawi mostly reallocates its production factors towards producing more traditional export crops and reallocates their destination accross exports partners out of the EU, the rest of the world and other countries in SSA towards the USA and emerging economies. But at the results of "DFQF", world price change drastically leading to a appreciating of terms of trade by 6 percent and an increase tariff revenue for the states by 15 percent driven by an increase in imports. Malawi's representative household is enable to consume more, hence welfare increase.

Apart from Malawi, the majority of LDC in SSA experiences both an increase in GDP and welfare as a result of DFQF. Additionally, although South Africa is excluded from the "DFQF" market access as a non LDC, it benefits from the increased growth of LDC who

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49 million). This is due to the fact the timid export led growth due to the new market access of the "DDA" does not compensate the larger terms of trade loss due to the increase in price of consumption goods, including of food which leads to a decrease in imports from the Quad countries in particular, and decreases real revenue, explaining the decrease in welfare.

[21]   Contrary to Malawi, Ethiopia and Bostwana experience a slightly negative welfare change (respectively -0.001 and -0.01 percent) despite a small increase in real GDP (0.002 and 0.0005 percent). In spite of the slight economic activity created by the reform (due to expanding exports to other Sub-Saharan African countries benefiting from DFQF in the case of Bostwana), the price of the consumption basket increases more the revenue of the representative household and it is not able to achieve the same level of utility.

increase their demand for imports from South African, as it is one of their main partners initially.

4.2.3. *Impacts of regional integration*

At the regional level, the level of tariff barrier that countries apply to each other is diverse and generally high. Initial intra-continental trade is also fairly low, which is why regional integration is feared to divert more trade than it creates. Additionnaly, at the subcontinental level, because of similar histories and agroecological conditions, countries tend to produce similar agricultural products; hence, competition among them is a real issue.

When the regional FTAs are created, independently of its scale, the trade creation will spur activities for the countries which are competitive within the FTA and displace partly imports from rest of the world leading to trade diversion and a tendancy to decrese terms of trade for the importing countries. The countries reaping the most from the FTA are the ones the most competitive at producing the goods demanded by the other countries at the level of the FTA, in particular consumer's goods. In both "Reg FTA" and "SSA FTA", most of the gains are in favor of South Africa and "Western Africa".

Additionally, one very important impact is the diminution of tariff revenue due to the reduction of tariff on imports. Considering the dependence of many African countries on tariff revenue for their government budget, it is a very sensitive issue. Table II.12 highlights that it is mostly Mozambique, Malawi, Zimbabwe and Zambia who suffer drastic loss of tariff revenue. Similarly, changes in terms of trade can affect many countries negatively due to trade diversion.

Countries in "Central Africa", Madagascar, Mauritius, and countries in "South Central Africa" are negatively affected by the "Regional FTA" scenario. Those countries are the ones that initially trade the least with the other countries from SSA. Overall trade diversion thus dominates for those countries. Enlarging the FTA to the rest of SSA, induces some of them ("Central Africa", Madagascar, and "South Central Africa") to benefit from the opportunities of export led growth and slightly increase their real GDP, although they still experience negative welfare changes

In the case of Malawi, Mozambique, Nigeria, Zambia and Zimbabwe, welfare and real GDP growth diverge in both "Regional FTA" and "SSA FTA" scenarios. One common feature of all those countries is that they are the ones who experience the most important

terms of trade losses according to Table II.12, together with experiencing significant tariff revenue losses. Those two evolutions are linked to the trade diversion effect on the FTA for those net importers of consumer's good. As a consequence of the FTA, those countries decrease their imports from the rest of the world on which they use to earn some tariffs revenue and rather import from within the FTA from less competitive partners, decreasing their terms of trade. Hence even though economic activity increases as they are given opportunities to exports to other countries within the FTA, overall it's more costly to import consumption goods, and other things being equal the utility of their representative agent decreases.

Additionally in the "SSA FTA", Bostwana and Tanzania, who benefited from the "Reg FTA" still experience a positive real GDP change but now also a welfare loss. In both cases, this is linked to an increase in trade diversion. This trade diversion traduces by the additional loss in terms of trade for Bostwana, and for Tanzania in the fact that the terms of trade, while still positive, is much lower than for "Reg FTA", and tariff revenue losses are significantly higher.

Ethiopia is a particular case since data on tariffs are lacking hence it is not affected by the tariff decrease, but by the changes of its trading context.

TABLE II.12 — IMPACTS ON TARIFF REVENUE AND TERMS OF TRADE FOR COUNTRIES IN SSA

	Per cent change in total tariff revenue				Per cent change in terms of trade			
	Reg FTA	SSA FTA	DDA*	DFQF *	Reg FTA	SSA FTA	DDA*	DFQF *
Botswana	-2.3	-0.6	-0.5	-0.1	0.0	-0.4	0.9	0.0
Central Africa	-0.1	-16.6	-2.2	0.2	0.0	-0.4	-0.4	0.0
Ethiopia	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	0.0
Madagascar	-0.4	-7.4	-3.5	0.7	0.0	-0.1	-0.6	0.7
Malawi	-49.3	-52.2	2.4	15.4	-1.6	-1.7	1.0	6.3
Mauritius	-0.3	-19.0	0.0	-0.1	0.0	-0.8	-0.1	0.0
Mozambique	-54.5	-55.1	0.4	1.8	-0.9	-1.0	0.1	0.7
Nigeria	-7.0	-13.2	-8.5	-0.1	-0.2	-0.4	-0.5	0.0
Rest of Eastern Africa	-3.3	-11.6	-1.5	4.1	-0.1	-0.6	0.1	1.5
Rest of SACU	-1.3	-1.1	-4.3	-0.6	0.3	0.3	-0.4	0.0
Rest of Western Africa	-4.0	-8.5	0.3	0.6	0.9	0.7	-0.1	0.2
Senegal	-1.6	-4.2	0.3	5.4	0.3	0.3	0.2	2.6
South Africa	0.9	3.1	-6.0	0.1	0.3	1.0	-0.1	0.0
South Central Africa	-9.8	-11.6	-0.3	0.7	-0.2	-0.3	-0.4	0.3
Tanzania	-6.1	-26.3	1.0	7.0	0.7	0.1	0.2	3.4
Uganda	-7.4	-21.3	0.9	3.8	0.3	0.4	0.3	1.5
Zambia	-62.2	-62.7	0.2	2.1	-1.9	-1.3	0.0	0.5
Zimbabwe	-68.8	-68.8	-2.2	0.5	-2.5	-2.6	0.2	0.0
Sub-Saharan Africa	-6.2	-11.7	-3.4	1.2	0.1	0.1	-0.2	0.3

Source: Authors's calculations from the results of the MIRAGE model

4.2.4. *Distributional impacts*

As was just described, the distribution of gains and losses differs depending on the type of trade integration, but also depending whether one looks at the effects on GDP or welfare.

It is noteworthy that South Africa comes out as one of the big winner from all scenarios, reaping most of the gains from regional integration, "DDA", and being also positively affected by "DFQF". As a consequence, any combination of those scenarios also brings positive significant changes for the country.

Nigeria would be negatively affected by regional integration, but gains the most from the DDA. On the contrary, Rest of Western Africa does benefit the most from regional integration and DFQF, but is negatively affected by a DDA.

Looking at the number of loosers in terms of welfare, both types of regional integration have a negative impact on a higher number of countries than multilateral integration would have, which could explain why regional integration is harder to agree on for those countries. DFQF reduces the number of losers the most, leading to losses only for some of the non-LDCs of the region.

4.3. Comparative impacts on increased value-added in agriculture

The modalities and level of trade integration impact the structure of production and the composition and destination of exports across regions and sectors.

In terms of exports structure, initially, Sub-Saharan Africa is the only region in the world exporting more raw agricultural products than processed agricultural products. Considering the stake of agricultural-led growth, the trade integration process should be coherent with the objective of increased value-added in agriculture.

Looking at the evolution of exports of Sub-Saharan African countries presented in Table II.13, regional integration creates more trade in volume than the multilateral scenarios, mainly because of the creation of trade in "other" goods (driven by "primary," "other manufactured products," and "textiles").

TABLE II.13 — CHANGE IN THE IN EXPORT VOLUME ($ BILLIONS) OF SSA

Absolute increase

(Percent change)

	DDA*	DFQF*	DDA+ DFQF*	Reg FTA	SSA FTA	DDA + Reg FTA*	DFQF +Reg FTA*	DDA+ DFQF+Reg FTA*
Raw ag	0.22 (1.53)	0.84 (5.72)	0.79 (5.35)	0.26 (1.77)	0.38 (2.58)	0.51 (3.43)	1.14 (7.74)	0.02 (0.10)
Processed ag	0.16 (1.42)	0.56 (5.09)	0.64 (5.82)	0.53 (4.80)	0.99 (8.95)	0.67 (6.08)	1.08 (9.8)	0.22 (2.03)
Fish	0.01 (2.77)	0.00 (-1.25)	0.01 (1.59)	0.00 (-0.05)	0.00 (0.10)	0.01 (2.75)	0.00 (-1.26)	0.00 (0.37)
Other	1.02 (0.63)	-0.22 (-0.14)	0.92 (0.57)	2.85 (1.76)	5.78 (3.58)	3.71 (2.30)	2.58 (1.60)	5.23 (3.23)
Total	1.41 (0.75)	1.18 (0.63)	2.36 (1.26)	3.64 (1.94)	7.15 (3.81)	4.90 (2.61)	4.80 (2.56)	5.47 (2.91)

*Scenario with specific treatment of GTAP data issues.
Source: Authors's calculations from the results of the MIRAGE model

Raw ag = raw agricultural products; Processed ag = processed agriculture products; Fish = fishing products; Other = primary and manufactured products and services.

In terms of additional volume of processed agricultural exports, there are broadly equivalent between "DFQF" and "Reg FTA", with an ambitious regional integration in the form of a "SSA FTA" bringing a 30 percent higher level of exports than the ambitious "DFQF" scenario proposed. Both types of regional integration further increase the total volume of exports with a large increase in manufactured and primary exports. Adding regional integration to the multilateral scenarios will more than double the export volumes from the region.

Table II.D.2 presents the distribution of changes in agricultural export volumes across Sub-Saharan African countries. The source of additional export changes depending on the type of exports and scenario. Mostly, additional raw agricultural exports come from South Africa, eastern Africa, Zimbabwe, and Malawi and additional processed agricultural exports come from South Africa, Rest of SACU, Zimbabwe, eastern Africa, and Tanzania.

TABLE II.14 — IMPACTS ON THE SHARE OF PROCESSED OVER TOTAL AGRICULTURAL GOODS IN SUB-SAHARAN AFRICAN PRODUCTION, EXPORTS AND IMPORTS OF SSA

					Additional					
		Initial	DDA*	DFQF*	DDA+ DFQF*	Reg FTA	SSA FTA	DDA + Reg FTA*	DFQF +Reg FTA*	DDA+ DFQF+ Reg FTA*
Production		46%	25%	34%	45%	128%	112%	67%	44%	31%
Exports to all destination		43%	41%	40%	45%	67%	72%	57%	49%	94%
Exports to	DC	41%	38%	38%	46%	52%	57%	26%	34%	63%
Exports to	EE	10%	15%	8%	9%	0%	0%	11%	8%	1%
Exports to	ODC	18%	28%	90%	84%	0%	0%	20%	87%	1%
Exports to	NA	18%	0%	9%	100%	47%	0%	100%	11%	0%
Exports to	SSA	66%	85%	0%	69%	66%	72%	66%	64%	72%
Imports from all destination		74%	90%	67%	77%	66%	72%	66%	63%	72%
Imports from	DC	74%	64%	73%	72%	n.	n.	0%	65%	n.
Imports from	EE	79%	100%	61%	89%	n.	n.	100%	37%	n.
Imports from	ODC	79%	0%	70%	70%	n.	n.	n.	0%	n.
Imports from	NA	66%	85%	0%	69%	66%	72%	66%	64%	72%
Imports from	SSA	89%	97%	73%	92%	n.	n.	99%	0%	n.

Source: Authors's calculations from the results of the MIRAGE model
Notes: *Scenario with specific treatment of GTAP data issues.
DC = developed countries; EE = emerging economies; ODC = other developing economies; NA = northern Africa; SSA = Sub-Saharan Africa.

The structure of production does not necessarily change in the same way the structure of exports does (Table II.14), since changes in production depend on changes in the exports, imports, and consumptions structures. Nevertheless, in the end, it is critical to take the structure of production into account to make sure which economy captures the value addition of the final goods created.

Multilateral integration concentrates the exports in raw agricultural products (Table II.14): additional agricultural exports created by trade integration are composed of 41 percent of processed agricultural goods for "DFQF." On the contrary, regional integration increases

the ratio of processed agricultural goods in total agricultural exports. The additional agricultural exports created with "Regional FTA" are composed of 67 percent of processed agricultural goods, and 72 percent with "SSA FTA"

The pattern of SSA agricultural exports and production observed can be further explained in light of the structure of the destination exports market. The ratio of processed agricultural goods changes drastically depending on the destination market, ranging initially from only 10 percent of agricultural exports to emerging economies being processed to 66 percent of agricultural exports to other Sub-Saharan African countries being processed. Indeed, looking at the composition of the agricultural trade created, the only destination market where Sub-Saharan Africa always exports more processed agricultural goods than unprocessed goods is the regional market. Three factors affect the evolution of the exports structure from increased trade integration. First, additional exports to a given destination follow the initial composition of exports to that destination. Hence, regional trade tends to foster more processed exports than trade to emerging economies or developed countries. Second, the composition of exports tends to follow the evolution of the tariff structure. By setting all tariffs to zero, regional integration and DFQF lead to higher cuts on processed goods than on raw products because of the existing tariff escalation (Table II.1). The ratio of processed to unprocessed agricultural exports to Sub-Saharan Africa will thus increase slightly in those scenarios. Third, competition from other exporters receiving similar preferences or benefiting from the same increased market access is crucial. With DDA and DFQF, the additional exports from SSA toward developed countries and emerging economies present an increased share of raw agricultural products. We can conclude that SSA cannot take advantage of the market access granted for processed products because it is less competitive than the Asian competitors benefitting from the same market access.

In the end one advantage of regional integration is that it increases the gains of SSA, in terms of GDP growth, welfare growth and share of agricultural production and exports that are processed, even when combined with multilateral integration.

4.4. Sensitivity to the outcomes of EPA negotiations

Considering that the EU is the main trade partner for Sub-Saharan African countries, the impact of potential outcomes of the current negotiations between the EU and Sub-Saharan countries is tested on the baseline and on other scenarios. The main results compared to the previous ones are presented in Table II.15.

TABLE II.15 — COMPARISON OF MAIN RESULTS FOR SUB-SAHARAN AFRICA WITH ALTERNATIVE SCENARIOS OF EPA NEGOTIATIONS

	Welfare (percent change)			Number of losers in SSA (welfare)			share processed in increased agricultural export volume		
	none	EPA	GSP	None	EPA	GSP	none	EPA	GSP
Baseline	n.a.	-0.01	-0.03	n.a.	13	8	n.a.	46%	0%
DDA*	0.03	0.02	0.01	9	11	9	41%	46%	0%
DFQF*	0.11	0.10	0.08	5	5	4	40%	43%	12%
Reg FTA	0.05	0.05	0.03	10	12	8	67%	54%	24%

Source: Author's calculations from the results of the MIRAGE model.
Note: *Scenario with specific treatment of GTAP data issues.

It is noteworthy that both the EPA and GSP would decrease overall SSA welfare and lead to a high number of losers. Thus it seems logical that their interaction with other scenarios could decrease welfare.

Similarly to previous results, we find that in terms of welfare, gains are of similar order of magnitude for regional integration and multilateral integration, DDA being the most beneficial in terms of GDP volume, closely followed by regional FTA. But DFQF is the most beneficial followed by regional FTA. Regional integration still fosters a higher share of processed agricultural exports, even if it is reduced by the interaction with either EPA or GSP. Independently of the outcome of EPA negotiations, regional integration brings twice as many losers as DFQF, but is closely followed by DDA.

Contrary to previous results, a combined regional and multilateral integration would highly decrease GDP and welfare gains, leading to losses in most Sub-Saharan African countries; the gains being concentrated in South Africa and Rest of Western Africa.

4.5. Discussion on the assumptions of the modeling framework

In order to determine to what extent the previous results can be the base of policy prescriptions, limitations of the modeling framework are examined with a particular attention to their impacts on the results, specifically as regards to the comparative impacts of multilateral and regional trade integration.

Many assumptions influence the absolute size of the results, but overall it is hard to tell whether impacts from trade integration tend to be over or underestimated. Indeed, as stated above, the choice of the static mode tends to decrease impacts by not considering the dynamic gains from trade, so does the perfect competition hypothesis which restricts gains from an increase in the number of varieties. But on the contrary, the close to perfect mobility of factors and full employment assumptions tend to be unrealistically high considering the

employment issues there is in all Sub-Saharan African countries. Nevertheless there is no reason why these assumptions should impact the regional and multilateral trade scenarios differently, hence the comparative analysis could be considered robust to change in those assumptions.

On the contrary, the data used could have influenced the comparative impacts at several levels.

i.   Informal trade being mostly composed of unprocessed agricultural goods in Sub-Saharan Africa, CGE analysis based on official data will undermine the importance of agriculture in the economy of those countries, and will not consider the impact of the shocks implemented on this unrepresented sector. Thus we underestimate initial internal trade, and our results tend to underestimate further prospects from regional integration compared to multilateral liberalization.

ii.   By considering full rate of utilization of preferences (by not considering non trade measures such as sanitary and phytosanitary standards SPS and rules of origin), we implicitly assume that Sub-Saharan African countries fully take advantage of future market of access. But in reality, those non trade measures will indeed hamper some countries to increase exports especially for trade in processed and value added products towards developed countries as part of preferential schemes –Duty Free Quota Free-. Hence, we tend to overestimate the prospects from increased trade integration at that level and for those products. On the contrary, if the agreement negotiated included effort to maximize the utilization rate, our results would rather tend to underestimate the expected gains.

iii.   Similarly, by not taking into account the trade costs, we implicitly assume that access to future markets is not constrained by physical and administrative costs. Hence we tend to overestimate the gains from all types of agreements. It might be that those costs are higher for intra regional trade, since they might be high for both trade partners. But it could also be assumed that cross border trade with regional partner within the same economic community might not be as expensive as exports to the rest of the world. It is actually very likely that the trade costs vary extensively across products and countries.

iv.   An additionnal factor that could impact the results is the value of the Armington elasticities. Typically changing the Armington elasticities induced substantial variations in the trade flows created by the tariffs cuts (Bouët 2008). Compared to other multicountry CGE model, MIRAGE introduces two specific features regarding the treatment of trade elasticities. First, products coming from developed countries and those from

developing countries are supposed to belong to different quality ranges, with a lower substitutability among products coming from different quality range. Second, domestic products are less substitutable for foreign products than foreign products are among one another within a given quality range. The highest elasticities used in the model are based on GTAP 7 elasticities, which are themselves lower than standard World Bank's elasticities. Since these features means that actually most elasticities applied on trade flows are lower than the standard GTAP ones, hence our results tend to be smaller than they would have been without those assumptions. Additionally these assumption tend to favor South-South trade (belonging to the same quality range), but the impact on a scenario such as the DFQF is ambiguous as increased market access is offered both developed countries (different quality range) and emerging economies from the same quality range as other Sub-Saharan African countries. Considering the important uncertainty surrounded Armington values, it is difficult to know which assumptions to test. Provided time, we could have controlled for the impact of not assuming different quality ranges among imported products, and different level of higher elasticities.

In the end, some of the assumptions have led to a tendency to underestimate the impacts from regional integration, hence taking into account these assumptions tend to even reinforce our results in favor of a strong potential from regional integration, but other assumptions have more ambiguous effects. The safest conclusion is that the overall effects of those elements on the comparative values of our results is ambiguous. Hence precautions should be adopted if using those results for policy recommendations.

5. Conclusions

The shifting trade context induces complex challenges and opportunities for Sub-Saharan African (SSA) countries pursuing agricultural-led industrialization. General equilibrium modeling is a convenient way to assess impacts of trade policies in a consistent framework. Many simulations in the past have considered SSA interests and constraints, and have highlighted important features of the trade liberalization proposals such as the erosion of preferences from multilateral integration, and the risk of tariff revenue and terms of trade losses at the regional level. But they have not compared the different schemes of trade integration. As there is no consensus on whether Sub-Saharan Africa should focus on regional or multilateral integration first, this paper brings new comparable results to fuel the debate on

setting priorities for trade policy reforms coherently with broader development strategies. Building from the most recent results of the agricultural economic literature, it assumes that increasing the transformation of agricultural goods is coherent with sustainable growth.

First, by simulating the Doha Development Agenda, an ambitious Duty-Free Quota-Free (DFQF) and a combination of the two agreements, we show that the DFQF proposal would indeed rebalance the gains from the Doha Round toward LDCs. But even in a "DDA+DFQF" scenario, developed countries would reap most of the gains.

Second, this paper reveals that regional integration could deliver as much as multilateral integration for SSA in terms of gross domestic product (GDP), welfare growth (defined as equivalent variation of the utility of the representative agent), and agricultural exports volumes.

Third, it highlights that patterns of agricultural export growth differs between trade integration schemes since they depend on initial trade patterns and are driven by the relative competitiveness of other exporters granted same market access. The simulations show that this consideration is crucial for perspectives of agricultural growth in SSA, since any multilateral integration would encourage further specialization of the region in the export of unprocessed agricultural exports. This trend is not coherent with the view that countries in SSA should not only diversify their export products and destinations, but also capture more value-added on their exports. On the contrary, deeper regional integration would foster the processing of agricultural exports. The implication of those results is that in order for a multilateral integration, even preferential such as the "DFQF," to be coherent with the stake of agricultural-led industrialization, countries in SSA need to first increase their competitiveness. Regional integration could be a way to do so, since it would enable most countries to combine increased exports volume and increase transformation of agricultural exports.

Fourth, looking at the distribution of gains and losses across Sub-Saharan African countries in terms of welfare, attention is drawn to the fact that more countries would experience a decrease in their welfare with regional integration than with multilateral integration, especially compared to "DFQF". But "DDA" would bring almost the same numbers of "losers" as regional integration. Accompanying policies to mitigate those losses might help the countries be more favorable to the regional option.

Finally, we wish to call GTAP data users to exercise caution when simulating drastic market access opening for Sub-Saharan African countries. Some well-documented data issues can contribute to "virtual trade flows" being created, leading to bias toward a significant overestimation of the potential benefits from multilateral trade integration.

APPENDIX A: Description of the MIRAGE Model

This paper uses the Modeling International Relationships in Applied General Equilibrium (MIRAGE) model, which is a multisector, multiregion economic model initially developed by the Centre d'Études Prospectives et d'Informations Internationales (CEPII), and the International Food Policy Research Institute (IFPRI) for trade policy analysis. It is a relatively standard, neoclassical model that assumes constant returns to scale and perfect competition in the agricultural sectors and allows for the assumption of imperfect competition in industry and services. The model has a sequential dynamic recursive set-up solved in a sequence of static equilibria linked by population and labor force growth, capital accumulation and productivity. The production function assumes perfect complementarity between value-added and intermediate consumption. On the value-added side, production makes use of five factors: land, skilled labor, unskilled labor, capital, and natural resources. Skilled labor and capital are perfectly mobile across sectors, but land is specific and imperfectly mobile in primary agriculture, and natural resources are specific to the extractive sectors.

Full employment is assumed for all factors except for land. The supply of land is endogenous and depends on the land supply elasticity of the country and on the real rate of remuneration. Skilled labor is perfectly mobile across sectors. Unskilled labor is imperfectly mobile between agricultural and nonagricultural sectors according to a constant elasticity of substitution (CES) function. Growth rates of labor supply are set exogenously. The supply of capital is modified each year by depreciation and investment. Installed capital is sector specific, but new capital is allocated among sectors according to an investment function that depends on the rates of return and the sector stock of capital.

The sectoral composition of the intermediate consumption aggregate stems from a CES function. For each sector of origin, the nesting is the same as for final consumption, meaning that the sector bundle has the same structure for final and intermediate consumption. On the demand side, the model assumes that each region has a representative agent whose utility function is intratemporal and allocates a fixed share of regional income to savings and uses the rest to purchase final consumption. Below the first-tier Cobb-Douglas function, the preferences for final consumption across sectors are represented by an LES-CES function.

The model assumes that products from developed and developing countries belong to two different quality ranges and the substitutability between products from the same quality range is stronger than between those from different quality ranges. Additionally, within a given quality range, there is less substitutability between domestic products and foreign products than between foreign products from different origins. The model's macroeconomic closure assumes endogenous real exchange rates while maintaining fixed trade balance, equal to the initial value for each region.

APPENDIX B: Supplementary Tables

TABLE II.B.1 — MAPPING OF THE SECTORAL DECOMPOSITION: 28 SECTORS OF WHICH 18 ARE AGRICULTURAL

Type of sector of interest	Sectoral decomposition	GTAP 7 sectoral abbreviation
Raw agricultural products	Cattle	ctl, cmt
	Cereals	gro
	Export crops	ocr
	Milk	rmk
	Oilseeds	osd
	Paddy rice	pdr
	Plants for fibers	pfb
	Sugar plant	c_b
	Vegetables and fruits	v_f
	Wheat	wht
Processed agricultural products	Beverages and tobacco	b_t
	Dairy	mil
	Meat	oap
	Other food products	ofd
	Oils and fats	vol
	OMeat	omt
	Processed rice	pcr
	Sugar	sgr
Fish	Fishing	fsh
Other	Animal fibers	wol
	Other Manufactured products	crp, nmm, omf
	Primary products	coa, oil, gas, omn, p_c, i_s, nfm, fmp
	Services	ely, gdt, wtr,
	Textile	tex, wap, lea
	Trade	trd
	Transport	otp, wtp, atp, cmn

Source: GTAP 7 database sectoral listing.

TABLE II.B.2 — MAPPING OF THE REGIONAL DECOMPOSITION: 29 REGIONS OF WHICH 18 ARE FROM SUB-SAHARAN AFRICA

Type of Zone of Interest	Regional decomposition	GTAP 7 regional abbreviation
Developed	EU	AUT, BEL, DNK, FIN, FRA, DEU, GRC, HUN, IRL, ITA, LUX, NLD, POL, PRT, ESP, SWE, GBR, NOR, ROU, BGR
	U.S.A.	USA
	Japan	JPN
	Rest of the World	AUS, NZL, XOC, CAN, XNA, CYP, CZE, EST, LVA, LTU, MLT, SVK, SVN, CHE, XEF, ALB, BLR, HRV, RUS, UKR, XEE, XER, KAZ, KGZ, XSU, ARM,
Emerging Economies	Brazil	BRA
	China	CHN
	India	IND
	Asian Tiger	HKG, KOR, TWN, MYS, SGP, THAI
Other Developing Countries	Rest of Asia	XEA, KHM, IDN, LAO, MNR, PHL, THA, XSE, BGD, PAK, LKA, XSA
	Rest of Southern America	MEX,ARG,BOL,CHL,COL,ECU,PRY,PER,URY,VEN,XSM,CRI,GTM,NIC,PAN, XCA, XCB
North Africa	Northern Africa	EGY, MAR, TUN, XNF

Sub-Saharan Africa	Botswana	BWA
	Ethiopia	ETH
	Madagascar	MDG
	Mozambique	MOZ
	Mauritius	MUS
	Malawi	MWI
	Nigeria	NGA
	Senegal	SEN
	Tanzania	TZA
	Uganda	UGA
	South Africa	ZAF
	Zambia	ZMB
	Zimbabwe	ZWE
	Rest of South Central Africa	XAC
	Central Africa	XCF
	Rest of Eastern Africa	XEC
	Rest of South African Customs Union	XSC
	Rest of Western Africa	XWF

Source: GTAP 7 database regional listing.

TABLE II.B.3 — DETAILS OF THE FOUR REGIONAL GROUPS AND THE CORRESPONDING GTAP 7 REGIONS AVAILABLE

EPA regions	Country	GTAP 7 regions	EPA regions	Country	GTAP 7 regions
Western African group	**Nigeria**	NGA	Eastern African group	**Ethiopia**	ETH
	Benin			**Madagascar**	MDG
	Burkina Faso			**Mauritius**	MUS
	Cape Verde			**Tanzania**	TZA
	Ivory Coast			**Uganda**	UGA
	Gambia			Burundi	
	Ghana			Comoros	
	Guinea			Djibouti	
	Guinea Bissau	XWF		Eritrea	
	Liberia			Kenya	XEC
	Mali			Rwanda	
	Mauritania			Seychelles	
	Niger			Somalia	
	Sierra Leone			Sudan	
	Togo			Congo (Democratic Republic)	XAC
	Senegal	SEN	Southern African group	Angola	XAC
Central African group	Cameroon			**Botswana**	BWA
	Central African Republic			**Mozambique**	MOZ
	Chad			Lesotho	
	Congo	XCF		Namibia	XSC
	Equatorial Guinea			Swaziland	
	Gabon			**Malawi**	MWI
	Sao Tome and Principe			**South africa**	ZAF
				Zambia	ZMB
				Zimbabwe	ZWE

Source: GTAP 7 database regional listing and latest update of www.acp-eu-trade.org.

APPENDIX C: Top 20 tariff cuts for SSA agricultural exports in the scenarios

TABLE II.C.1 — TOP 20 TARIFF CUTS FOR SSA AGRICULTURAL EXPORTS IN THE DDA SCENARIO

Exporters	Importers	Sectors	Tariff cut (as percent of initial tariff)	Equivalent tariff reduction	Tariff in the DDA scenario	Initial trade (10^6 $)
Malawi	U.S.A.	Exports Crops	-60.79	-0.32	0.20	55.58
Rest of Eastern Africa	Asian Tigers	Oilseeds	-67.71	-0.71	0.34	20.40
Rest of Eastern Africa	Rest of the World	Cattle	-19.01	-0.02	0.08	209.06
Rest of Eastern Africa	Rest of the World	Exportable crops	-35.08	-0.06	0.12	132.19
Rest of Western Africa	Japan	Other food products	-41.10	-0.02	0.04	130.66
Rest of Western Africa	Nigeria	Other food products	-25.96	-0.07	0.19	67.00
Rest of Western Africa	Nigeria	Vegetables and fruits	-50.00	-0.50	0.50	8.35
Rest of Western Africa	Nigeria	Beverages and tobacco	-64.50	-0.90	0.50	3.48
South Africa	Asian Tigers	Vegetables and fruits	-52.39	-0.10	0.09	71.54
South Africa	Asian Tigers	Other food products	-50.22	-0.07	0.07	69.67
South Africa	Asian Tigers	Sugar	-52.13	-0.11	0.10	40.92
South Africa	Japan	Other food products	-47.21	-0.06	0.07	64.97
South Africa	Japan	Vegetables and fruits	-49.54	-0.06	0.06	43.01
South Africa	Japan	Sugar	-30.25	-0.36	0.83	28.46
South Africa	Nigeria	Beverages and tobacco	-59.73	-0.69	0.47	21.27
South Africa	Nigeria	Other food products	-35.26	-0.16	0.30	16.81
South Africa	Rest of the World	Vegetables and fruits	-31.51	-0.04	0.09	203.83
South Africa	Rest of the World	Other food products	-15.98	-0.02	0.12	153.94
South Africa	Rest of the World	Beverages and tobacco	-17.71	-0.06	0.29	75.39
Zimbabwe	U.S.A.	Exports crops	-66.51	-0.37	0.18	14.06

Source: Author's calculations, reference-group weight aggregating method.

TABLE II.C.2 — TOP 20 TARIFF CUTS FOR SSA AGRICULTURAL EXPORTS IN THE DFQF SCENARIO

Exporters	Importers	Sectors	Tariff cut (as percent of initial tariff)	Equivalent tariff reduction	Tariff in the DFQF scenario	Initial trade (106 $)
Malawi	India	Vegetables and fruits	-100	-0.44	0.00	3.45
Malawi	Rest of South America	Other food products	-87	-0.26	0.04	8.44
Malawi	Rest of the World	Other food products	-15	-0.02	0.14	63.84
Malawi	U.S.A.	Other food products	-100	-0.52	0.00	55.58
Mozambique	India	Vegetables and fruits	-100	-0.31	0.00	23.85
Mozambique	India	Sugar	-100	-1.00	0.00	2.43
Rest of Eastern Africa	Asian Tigers	Oilseeds	-94	-0.99	0.06	20.40
Rest of Eastern Africa	India	Vegetables and fruits	-45	-0.16	0.20	9.61
Rest of Eastern Africa	Japan	Exports crops	-84	-0.06	0.01	53.14
Rest of Eastern Africa	Rest of South America	Exports crops	-41	-0.07	0.10	29.19
Rest of Eastern Africa	Rest of the World	Cattle	-46	-0.05	0.06	209.06
Rest of Eastern Africa	Rest of the World	Oilseeds	-46	-0.04	0.05	94.94
Rest of Western Africa	Asian Tigers	Oilseeds	-65	-0.23	0.12	5.43
Rest of Western Africa	India	Vegetables and fruits	-50	-0.16	0.17	157.55
Rest of Western Africa	India	Plant for fibers	-95	-0.09	0.01	47.91
Rest of Western Africa	Japan	Other food products	-14	-0.01	0.05	130.66
Tanzania	India	Vegetables and fruits	-100	-0.31	0.00	67.55
Tanzania	India	Plant for fibers	-100	-0.10	0.00	13.04
Tanzania	India	Exports crops	-100	-0.78	0.00	2.79
Uganda	U.S.A.	Exports crops	-100	-0.15	0.00	17.36

TABLE II.C.3 — TOP 20 TARIFF CUTS FOR SSA AGRICULTURAL EXPORTS IN THE DDA+DFQF
SCENARIO

Exporters	Importers	Sectors	Tariff cut (as percent of initial tariff)	Equivalent tariff reduction	Tariff in the DDA+ DFQF scenario	Initial trade (10⁶ $)
Malawi	U.S.A.	Exports crops	-100	-0.52	0.00	55.58
Mozambique	India	Vegetables and fruits	-100	-0.31	0.00	23.85
Rest of Eastern Africa	Asian Tiger	Oilseeds	-98	-1.02	0.02	20.40
Rest of Eastern Africa	Rest of the World	Cattle	-47	-0.05	0.06	209.06
Rest of Eastern Africa	Rest of the World	Exports crops	-36	-0.07	0.12	132.19
Rest of Eastern Africa	Rest of the World	Oilseeds	-53	-0.05	0.04	94.94
Rest of Western Africa	India	Vegetables and fruits	-50	-0.16	0.17	157.55
Rest of Western Africa	India	Plant fiber	-95	-0.09	0.01	47.91
Rest of Western Africa	Japan	Other food products	-50	-0.03	0.03	130.66
Rest of Western Africa	Nigeria	Other food products	-26	-0.07	0.19	67.00
Rest of Western Africa	Nigeria	Vegetables and fruits	-50	-0.50	0.50	8.35
South Africa	Asian Tiger	Vegetables and fruits	-52	-0.10	0.09	71.54
South Africa	Asian Tiger	Other food products	-50	-0.07	0.07	69.67
South Africa	Asian Tiger	Sugar	-52	-0.11	0.10	40.92
South Africa	Japan	Sugar	-30	-0.36	0.83	28.46
South Africa	Nigeria	Beverages and tobacco	-60	-0.69	0.47	21.27
South Africa	Rest of the World	Vegetables and fruits	-32	-0.04	0.09	203.83
South Africa	Rest of the World	Beverages and tobacco	-18	-0.06	0.29	75.39
Tanzania	India	Vegetables and fruits	-100	-0.31	0.00	67.55
Zimbabwe	U.S.A.	Exports crops	-67	-0.37	0.18	14.06

TABLE II.C.4 — TOP 20 TARIFF CUTS FOR SSA AGRICULTURAL EXPORTS IN THE REGIONAL FTA
SCENARIO

Exporters	Importers	Sectors	Tariff cut (as percent of initial tariff)	Equivalent tariff reduction	Tariff in the regional FTA scenario	Initial trade (10^6 $)
Rest of SACU	Rest of Southern Africa	Beverage and tobacco	-83	-0.23	0.05	67.50
Rest of Eastern Africa	Rest of Eastern Africa	Other exportable crops	-100	-0.11	0.00	47.62
Rest of Eastern Africa	Rest of Eastern Africa	Other food products	-100	-0.10	0.00	28.36
Rest of Eastern Africa	Rest of Eastern Africa	Vegetables and fruits	-100	-0.17	0.00	16.41
Rest of Western Africa	Nigeria	Beverage and tobacco	-100	-1.40	0.00	3.48
Rest of Western Africa	Nigeria	Cattle	-100	-0.19	0.00	40.37
Rest of Western Africa	Nigeria	Oil fats	-100	-0.69	0.00	6.16
Rest of Western Africa	Nigeria	Other food products	-100	-0.26	0.00	67.00
Rest of Western Africa	Nigeria	Vegetables and fruits	-100	-1.00	0.00	8.35
Rest of Western Africa	Rest of Western Africa	Oil fats	-100	-0.04	0.00	75.12
Rest of Western Africa	Rest of Western Africa	Other food products	-100	-0.08	0.00	213.22
Rest of Western Africa	Rest of Western Africa	Plant for fibers	-100	-0.05	0.00	182.43
Rest of Western Africa	Rest of Western Africa	Vegetables and fruits	-100	-0.12	0.00	39.14
South Africa	Mozambique	Other food products	-100	-0.19	0.00	33.10
South Africa	Mozambique	Vegetables and fruits	-100	-0.22	0.00	16.56
South Africa	Rest of Southern Africa	Beverage and tobacco	-55	-0.13	0.10	86.37
Tanzania	Rest of Eastern Africa	Other exportable crops	-100	-0.21	0.00	17.88
Tanzania	Rest of Eastern Africa	Other food products	-100	-0.28	0.00	28.25
Uganda	Rest of Eastern Africa	Other exportable crops	-100	-0.11	0.00	35.71
Zimbabwe	Rest of Southern Africa	Sugar	-100	-0.20	0.00	15.86

Source: Author's calculations, reference-group weight aggregating method.

TABLE II.C.5 — TOP 20 TARIFF CUTS FOR SSA AGRICULTURAL EXPORTS IN THE SSA FTA SCENARIO

Exporters	Importers	Sectors	Tariff cut (as percent of initial tariff)	Equivalent tariff reduction	Tariff in the SSA FTA scenario	Initial trade (10^6 $)
Mozambique	Malawi	Exports crops	-100	*-0.22*	0.00	26.13
Rest of SACU	Rest of Southern Africa	Beverage and tobacco	-100	*-0.28*	0.00	67.50
Rest of Eastern Africa	Rest of Eastern Africa	Other foodcrops	-100	*-0.11*	0.00	47.62
Rest of Western Africa	Nigeria	Other foodcrops	-100	*-0.26*	0.00	67.00
Rest of Western Africa	Nigeria	Cattle	-100	*-0.19*	0.00	40.37
Rest of Western Africa	Nigeria	Vegetable and fruits	-100	*-1.00*	0.00	8.35
Rest of Western Africa	Nigeria	Beverage and tobacco	-100	*-1.40*	0.00	3.48
Rest of Western Africa	Rest of Central Africa	Other foodcrops	-100	*-0.24*	0.00	34.31
Rest of Western Africa	Rest of Western Africa	Other foodcrops	-100	*-0.08*	0.00	213.22
Rest of Western Africa	Rest of Western Africa	Plant for fibers	-100	*-0.05*	0.00	182.43
South Africa	Mauritius	Sugar	-100	*-0.80*	0.00	10.32
South Africa	Mozambique	Other foodcrops	-100	*-0.19*	0.00	33.10
South Africa	Nigeria	Beverage and tobacco	-100	*-1.16*	0.00	21.27
South Africa	Nigeria	Other foodcrops	-100	*-0.46*	0.00	16.81
South Africa	Rest of Eastern Africa	Sugar	-100	*-0.31*	0.00	20.16
South Africa	Rest of Southern Africa	Beverage and tobacco	-100	*-0.23*	0.00	86.37
South Africa	Zimbabwe	Cereals	-100	*-0.25*	0.00	61.75
South Africa	Zimbabwe	Other foodcrops	-100	*-0.29*	0.00	30.27
South Africa	Zimbabwe	Exports crops	-100	*-0.60*	0.00	13.29
Tanzania	Rest of Eastern Africa	Other foodcrops	-100	*-0.28*	0.00	28.25

Source: Author's calculations, reference-group weight aggregating method.

TABLE II.C. 6 — TOP 20 TARIFF CUTS FOR SSA AGRICULTURAL EXPORTS IN THE EPA SCENARIO

Exporters	Importers	Sectors	Tariff cut (as percent of initial tariff)	Equivalent tariff reduction	Tariff in the SSA FTA scenario	Initial trade (10^6 $)
Mauritius	EU	Other food products	-33	-0.03	0.05	0.12
Nigeria	EU	Exports crops	-52	-0.01	0.01	0.73
Nigeria	EU	Other food products	-63	-0.07	0.04	0.45
Rest of Central Africa	EU	Vegetable and fruits	-26	-0.04	0.10	0.21
Rest of Eastern Africa	EU	Exports crops	-22	-0.02	0.05	1.22
Rest of Eastern Africa	EU	Other food products	-40	-0.03	0.04	1.34
Rest of Eastern Africa	EU	Vegetable and fruits	-12	-0.01	0.08	0.30
Rest of SACU	EU	Other food products	-39	-0.07	0.11	0.62
Rest of Western Africa	EU	Exports crops	-41	-0.01	0.01	8.67
Rest of Western Africa	EU	Oilseeds	-32	-0.01	0.02	0.38
Rest of Western Africa	EU	Other food products	-33	-0.02	0.04	9.76
Rest of Western Africa	EU	Vegetable and fruits	-17	-0.01	0.06	0.21
South Africa	EU	Beverage and tobacco	-45	-0.13	0.16	0.06
South Africa	EU	Exports crops	-45	-0.05	0.06	1.15
South Africa	EU	Meat	-37	-0.02	0.03	1.04
South Africa	EU	Oilseeds	-68	-0.07	0.03	0.06
South Africa	EU	Other food products	-43	-0.08	0.10	0.75
South Africa	EU	Sugar	-54	-0.11	0.10	5.11
South Africa	EU	Vegetable and fruits	-45	-0.08	0.10	2.33
Zimbabwe	EU	Exports crops	-53	-0.08	0.07	11.12

Source: Author's calculations, reference-group weight aggregating method.

TABLE II.C.7 — TOP 20 TARIFF INCREASES FOR SSA AGRICULTURAL EXPORTS TO THE EU IN THE GSP
SCENARIO

Exporters	Importers	Sectors	Tariff increase (percent of initial tariff)	*Ad valorem* equivalent tariff increase	Tariff in the GSP scenario	Initial trade (10^6 $)
Mauritius	EU	Other food products	13	0.01	0.09	0.12
Mauritius	EU	Sugar	251	0.26	0.37	0.11
Nigeria	EU	Other food products	2	0.00	0.11	0.45
Rest of Central Africa	EU	Oilseeds	2	0.00	0.09	0.00
Rest of Central Africa	EU	Other food products	6	0.01	0.18	0.02
Rest of Central Africa	EU	Vegetables and fruits	19	0.03	0.16	0.21
Rest of Eastern Africa	EU	Oilseeds	0	0.00	0.04	1.16
Rest of Eastern Africa	EU	Other food products	3	0.00	0.07	1.34
Rest of Eastern Africa	EU	Vegetables and fruits	0	0.00	0.09	0.30
Rest of SACU	EU	Cereals	9	0.01	0.18	0.00
Rest of SACU	EU	Meat	1	0.00	0.06	0.01
Rest of SACU	EU	Other food products	10	0.02	0.19	0.62
Rest of SACU	EU	Sugar	228	0.21	0.30	0.13
Rest of SACU	EU	Vegetables and fruits	1	0.00	0.19	0.02
Rest of Western Africa	EU	Exports crops	0	0.00	0.03	8.67
Rest of Western Africa	EU	Oilseeds	3	0.00	0.04	0.38
Rest of Western Africa	EU	Other food products	2	0.00	0.06	9.76
Rest of Western Africa	EU	Vegetables and fruits	11	0.01	0.08	0.21
Zimbabwe	EU	Other food products	14	0.01	0.09	0.01
Zimbabwe	EU	Vegetables and fruits	7	0.01	0.13	0.02

Source: Author's calculations, reference-group weight aggregating method.

APPENDIX D:Country-level impacts on SSA

TABLE II.D.1 — IMPACTS ON THE REAL GDP OF SUB-SAHARAN AFRICAN COUNTRIES

| | | Absolute real GDP change (mln $) | | | | | | |
	Initial	Reg FTA	*SSA FTA*	*DDA**	*DFQF**	DDA+ DFQF*	DDA+ RegFTA*	DFQF+ Reg FTA*
Botswana	8,696	0.8	1.9	0.7	0.0	0.8	1.4	0.9
CentralAf	38,273	-1.1	26.3	0.1	1.6	1.3	-1.0	0.5
Ethiopia	7,019	-0.1	-0.2	-0.8	0.1	-0.7	-0.9	0.0
Mada	4,417	0.0	0.0	-2.5	0.6	-1.8	-2.6	0.6
Malawi	1,842	1.3	1.9	-15.4	-6.2	-11.0	-14.6	-8.1
Mauritius	6,240	-0.1	-7.0	-3.9	-0.5	-3.6	-4.0	-0.4
Mozambique	6,072	10.2	10.6	0.7	8.0	7.1	10.9	18.6
Nigeria	68,819	34.9	83.8	330.9	-3.9	327.7	363.1	32.0
RoEastAf	50,600	9.1	-2.1	32.6	113.0	116.4	42.4	123.4
RoSACU	9,103	5.8	9.0	-8.7	-1.6	-9.1	-2.8	4.3
RoWestAf	50,843	83.0	85.4	-0.9	27.5	24.3	69.5	109.8
Senegal	7,222	3.3	4.5	1.1	27.9	26.1	4.1	30.3
SthAfrica	214,356	114.0	346.3	173.3	7.8	179.8	284.3	124.3
SthCentAf	24,785	-6.5	10.3	-12.7	12.7	-2.4	-19.2	5.8
Tanzania	11,537	10.6	11.2	2.9	25.7	27.3	13.2	35.0
Uganda	7,298	0.6	4.8	0.9	6.4	5.0	1.4	7.0
Zambia	5,432	31.6	37.2	-1.4	4.2	2.7	30.1	35.3
Zimbabwe	4,121	29.2	29.9	-4.4	1.6	-3.4	23.6	30.2
SSA	526,675	327	654	492	225	686	799	550

Source: Author's calculations from the results of the MIRAGE model

TABLE II.D.2 —IMPACTS ON THE AGRICULTURAL EXPORTS VOLUME ($ MILLIONS) OF SUB-SAHARAN
AFRICAN COUNTRIES

		Initial	Absolute change							
			Reg FTA	SSA FTA	DDA*	DFQF*	DDA+ DFQF*	DDA + Reg*	DFQF +Reg*	DDA+ DFQF+ Reg*
Botswana	Raw ag	70	0.10	0.09	-0.44	-0.05	-0.47	-0.35	0.05	-0.04
Botswana	Processed ag	63	1.09	1.72	-0.93	-0.13	-0.99	0.18	0.96	-1.71
Central Africa	Raw ag	855	-0.75	30.94	15.12	4.06	17.97	14.22	3.28	15.37
Central Africa	Processed ag	191	-0.29	12.18	2.33	14.16	6.52	2.08	13.88	-19.56
Ethiopia	Raw ag	437	-0.52	-1.51	-10.76	0.55	-10.03	-11.35	-0.03	-12.52
Ethiopia	Processed ag	95	-0.36	-0.68	-2.25	0.24	-2.10	-2.61	-0.13	-1.71
Madagascar	Raw ag	285	-0.05	0.92	-6.19	-0.19	-3.15	-6.30	-0.45	-10.16
Madagascar	Processed ag	290	0.75	2.34	14.38	10.58	13.73	14.80	11.40	-0.01
Malawi	Raw ag	336	43.49	48.70	53.34	208.73	180.06	104.59	278.15	48.32
Malawi	Processed ag	76	6.44	3.44	-4.40	-14.66	-14.50	1.79	-9.78	1.78
Mauritius	Raw ag	11	0.16	0.45	0.79	-0.06	0.72	0.95	0.09	1.22
Mauritius	Processed ag	843	-1.86	17.70	-22.18	3.36	-20.16	-23.83	1.55	-275.33
Mozambique	Raw ag	156	45.85	48.77	6.15	63.94	57.06	54.23	121.21	45.38
Mozambique	Processed ag	157	16.27	18.19	-0.08	4.96	4.33	15.89	20.98	9.37
Nigeria	Raw ag	413	12.09	18.90	19.23	1.32	19.39	28.77	13.35	14.91
Nigeria	Processed ag	146	10.46	16.99	7.08	0.64	7.64	17.51	11.20	17.74
Rest of Eastern Africa	Raw ag	2,046	42.00	95.37	56.02	338.61	241.10	97.29	379.84	-77.38
Rest of Eastern Africa	Processed ag	994	65.92	89.26	48.72	171.72	245.11	114.77	238.31	61.47
Rest of SACU	Raw ag	237	1.07	-1.28	9.99	0.97	10.38	10.83	2.14	5.72
Rest of SACU	Processed ag	1,104	48.71	108.70	31.06	7.82	35.81	74.99	57.05	93.79
Senegal	Raw ag	74	0.15	0.20	-0.09	0.92	0.66	0.03	1.14	-2.58
Senegal	Processed ag	402	5.36	13.67	6.01	45.79	39.09	11.29	50.08	-19.28
South Africa	Raw ag	2,708	73.50	78.85	66.86	9.35	73.64	139.48	84.38	-48.83
South Africa	Processed ag	3,488	167.17	392.28	49.29	8.04	56.50	218.08	178.28	210.31
South Central Africa	Raw ag	23	0.97	1.81	0.05	15.92	15.75	1.02	17.58	1.27
South Central Africa	Processed ag	62	2.72	15.01	1.65	43.28	19.94	4.36	47.38	11.44
Tanzania	Raw ag	535	20.26	36.28	4.87	112.57	107.61	25.30	130.37	22.38
Tanzania	Processed ag	375	52.06	60.45	9.48	229.18	226.38	61.41	269.28	40.42
Uganda	Raw ag	398	9.24	10.98	3.31	18.75	16.98	12.37	27.79	7.86
Uganda	Processed ag	217	12.74	24.78	5.32	28.65	10.66	17.96	40.51	22.29
Zambia	Raw ag	317	-3.55	-13.17	4.96	10.42	9.74	1.47	6.15	-18.60
Zambia	Processed ag	65	5.42	29.38	0.49	0.33	0.35	6.12	5.75	29.20
Zimbabwe	Raw ag	677	85.92	80.15	26.85	3.21	27.96	113.44	89.87	103.31
Zimbabwe	Processed ag	300	45.18	51.99	-2.86	0.75	-2.16	38.16	46.05	-41.42

Source: Author's calculations from the results of the MIRAGE model

TABLE II.D.3 — IMPACTS ON TARIFF REVENUE, TERMS OF TRADE AND ALLOCATION EFFICIENCY

	Per cent change in total tariff revenue				Percent change in terms of trade				Percent change in allocation efficiency			
	Reg FTA	SSA FTA	DDA*	DFQF*	Reg FTA	SSA FTA	DDA*	DFQF*	Reg FTA	SSA FTA	DDA*	DFQF*
Botswana	-2.3	-0.6	-0.5	-0.1	-0.03	-0.38	0.87	-0.02	0.01	0.02	0.01	0.00
Central Africa	-0.1	-16.6	-2.2	0.2	-0.01	-0.39	-0.40	0.04	0.00	0.10	0.00	0.00
Ethiopia	0.0	0.0	0.0	0.0	-0.02	-0.06	-0.25	0.03	0.00	0.00	0.00	0.00
Madagascar	-0.4	-7.4	-3.5	0.7	-0.01	-0.10	-0.59	0.66	0.00	0.00	-0.05	0.01
Malawi	-49.3	-52.2	2.4	15.4	-1.56	-1.73	0.96	6.30	0.08	0.10	0.10	0.72
Mauritius	-0.3	-19.0	0.0	-0.1	0.00	-0.84	-0.13	-0.01	0.00	0.08	-0.03	-0.01
Mozambique	-54.5	-55.1	0.4	1.8	-0.87	-1.02	0.06	0.67	0.09	0.09	0.00	0.05
Nigeria	-7.0	-13.2	-8.5	-0.1	-0.25	-0.43	-0.53	-0.05	0.14	0.23	0.45	-0.01
Rest of Eastern Africa	-3.3	-11.6	-1.5	4.1	-0.05	-0.57	0.06	1.47	0.02	0.02	0.07	0.17
Rest of SACU	-1.3	-1.1	-4.3	-0.6	0.27	0.34	-0.36	-0.05	0.06	0.09	-0.09	-0.02
Rest of Western Africa	-4.0	-8.5	0.3	0.6	0.87	0.69	-0.08	0.23	0.08	0.08	0.00	0.03
Senegal	-1.6	-4.2	0.3	5.4	0.30	0.35	0.23	2.60	0.02	0.03	0.00	0.16
South Africa	0.9	3.1	-6.0	0.1	0.31	0.98	-0.09	0.01	0.05	0.14	0.08	0.00
South Central Africa	-9.8	-11.6	-0.3	0.7	-0.22	-0.33	-0.37	0.27	-0.04	0.05	-0.05	0.04
Tanzania	-6.1	-26.3	1.0	7.0	0.68	0.15	0.22	3.41	0.06	0.06	0.02	0.12
Uganda	-7.4	-21.3	0.9	3.8	0.29	0.45	0.33	1.48	-0.01	0.05	0.01	0.05
Zambia	-62.2	-62.7	0.2	2.1	-1.94	-1.26	-0.04	0.55	0.60	0.70	-0.03	0.06
Zimbabwe	-68.8	-68.8	-2.2	0.5	-2.50	-2.63	0.22	0.05	0.75	0.77	0.10	0.03
Sub-Saharan Africa	-2.1%	-3.9%	-1.1%	0.4%	0.06	0.13	-0.16	0.26				

Source: Author's calculations from the results of the MIRAGE model.

APPENDIX E: Treatment of some data issues in GTAP 7

As already documented by David Laborde[22] and other contributors of the GTAP network, there are several issues in the GTAP 7 database that if combined can lead to a strong overestimation of gains from trade liberalization. Following is a description of those issues, an explanation of the way they are treated in this paper suggested by David Laborde and an example of the extent to which they can affect the results of trade liberalization scenarios. A reference to this issue is the forthcoming Bouet and Laborde (2011.).

Starting from the GTAP 6 database, travelers' expenditures were added to merchandise trade flows by sector instead of being attributed to a tourism sector. For instance, it means that the consumption by Asian tourists and temporary workers in Africa is accounted in the GTAP 7 database as exports of goods from Africa to Asia. These virtual trade flows increase the bilateral trade flows on which tariff barriers are applied. Thus by comparing trade databases, we can see that the trade flows from some African countries (mainly eastern Africa, Tanzania, Senegal, and Madagascar) to some Asian countries (mainly Japan, China, and India) of goods in GTAP 7 are higher than in other trade databases such as COMTRADE.

Since by default tariff barriers are applied to the overall trade flows, if those tariffs are reduced following liberalization, such as in the DFQF scenario (and to some smaller extent the DDA scenario), those virtual export flows will also expand. The extent to which they will expand is linked to the height of the initial tariff applied,

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22   See https://www.gtap.agecon.purdue.edu/databases/v7/v7_data_issues.asp.

the importance of the demand for the good in the importing country, and the supply capacity of the exporting country.

If initially the sectors were protected by prohibitive tariffs and the demand in importing countries is high, such as rice in Japan, then this export market becomes attractive to countries that were already exporting despite the high tariff (Senegal Tanzania, Madagascar, and Rest of Eastern Africa, for instance), and those countries are considered competitive in exporting there. In the end, the extent to which those countries will increase their rice exports to Japan will depend on their supply capacity. As in MIRAGE, land is perfectly substitutable among agricultural sectors, and we will observe a shift in agricultural production toward rice in those countries (which is not realistic since rice should be irrigated in Africa). But if additionally in the country-level input/output data of GTAP 7 rice production requires low quantity of production factors and intermediate inputs, then the supply increases disproportionally: It is specifically so for Senegal, where imported wheat is the main intermediate input of processed rice (16 percent of intermediate consumption and only 12 percent of paddy rice), and Tanzania, where processed rice is exclusively made of paddy rice (which does not require a lot of land) and almost no factor of production. Those discrepancies are common in developing countries' input/output tables in GTAP 7 and stem partly from bad contributed tables and partly from error in the sectoral repartition of intermediate consumption and factor uses.

In this paper, the treatment applied was to consider all trade flows from Sub-Saharan African countries to Asian countries in paddy rice, processed rice, and raw milk as virtual flows that should not be liberalized in the multilateral scenario. The impacts on welfare by countries are shown in Table E.1.

TABLE II.E.1 — IMPACTS ON WELFARE ($ MILLIONS)

	Initial Welfare	Absolute change								
		DDA	DDA*	DDA* /DDA	DFQF	DFQF*	DFQF* /DFQF	DDA+ DFQF*	DDA+ DFQF	DDA+DFQF* /DDA+DFQF
EU	10,593,543	13,794	13,795	100%	-294	-125	42%	13,541	13,712	101%
U.S.A.	10,037,684	4,719	4,720	100%	185	175	94%	4,762	4,754	100%
Japan	3,445,072	10,919	10,890	100%	1,963	69	4%	12,113	10,948	90%
Rest of the world	3,228,432	3,585	3,585	100%	-23	8	-33%	3,571	3,604	101%
Rest of Latin America	1,204,656	-544	-544	100%	-60	-31	52%	-583	-552	95%
Asian Tiger	893,668	597	596	100%	71	3	4%	615	562	91%
China	892,423	-1,007	-1,007	100%	-85	-105	125%	-1,060	-1,072	101%
Rest of Asia	579,493	563	564	100%	538	491	91%	857	834	97%
India	509,224	11	11	102%	-50	-61	122%	-19	-23	123%
Brazil	461,614	7	7	100%	-22	-41	192%	3	-15	-594%
North Africa	202,237	-558	-558	100%	15	-1	-5%	-547	-559	102%
South Africa	173,614	91	91	100%	60	8	14%	146	98	67%
Rest of Western Africa	50,051	-5	-6	105%	73	40	55%	60	32	53%
Rest of Eastern Africa	45,921	25	25	100%	239	193	81%	209	169	81%
Nigeria	38,263	141	141	100%	-11	-15	139%	132	128	97%
Central Africa	24,338	-49	-49	100%	2	5	302%	-48	-44	93%
South Central Africa	19,620	-52	-52	100%	32	34	106%	-22	-20	93%
Tanzania	10,624	11	10	94%	1,729	58	3%	1,671	65	4%
Senegal	7,783	7	7	99%	459	51	11%	429	53	12%
Ethiopia	7,417	2	2	100%	0.1	-0.1	-157%	3	2	93%
Uganda	6,086	5	5	100%	37	20	53%	34	19	55%
Rest of SACU	6,038	-25	-25	100%	1	-3	-481%	-21	-25	118%
Botswana	6,000	24	24	100%	-1	-0.4	28%	23	23	104%
Mozambique	5,165	2	2	100%	15	15	99%	14	14	99%
Mauritius	4,691	-7	-7	100%	3	-1	-28%	-3	-7	195%
Zambia	4,428	-2	-2	100%	14	11	78%	11	8	72%
Zimbabwe	3,452	-3	-3	100%	8	2	24%	3	-2	-73%
Madagascar	3,375	-12	-12	103%	79	12	15%	61	-1	-2%
Malawi	1,958	-7	-7	100%	30	32	107%	19	21	110%
World	32,466,867	32,233	32,203	100%	5,009	843	17%	35,974	32,726	91%

Source: Author's calculations from the results of the MIRAGE model.
Note: The symbol "*" indicates scenarios with the treatment of virtual flows.

We can see that this does not change the results from DDA much, but that it does reduce the world gains from DFQF by 83 percent. Indeed, most of the gains from untreated DFQF are driven by Tanzania (39 percent), Japan (35 percent), Rest of Asia (11 percent), and Senegal (9 percent), which are reduced respectively by 97 percent, 96 percent, 9 percent, and 89 percent by the treatment. In the DFQF* simulation, most of the gains are then driven by Rest of Asia, in which most of Asian LDCs are aggregated, and in Africa by Rest of Eastern Africa.

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